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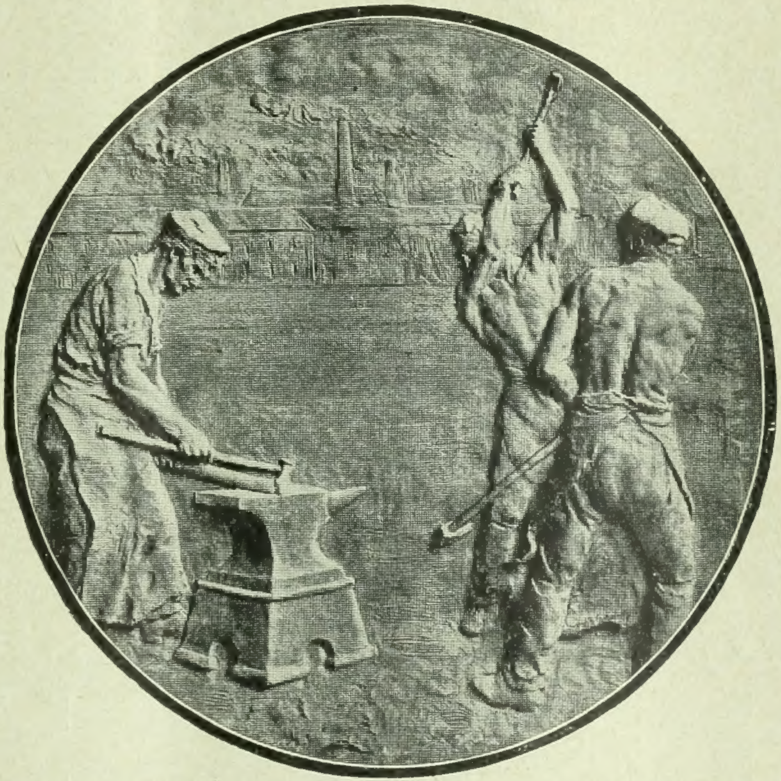
SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
SEPTEMBER 22, 1905.

OC '2 1905
UNIVERSITY RONTO

PAGE'S WEEKLY



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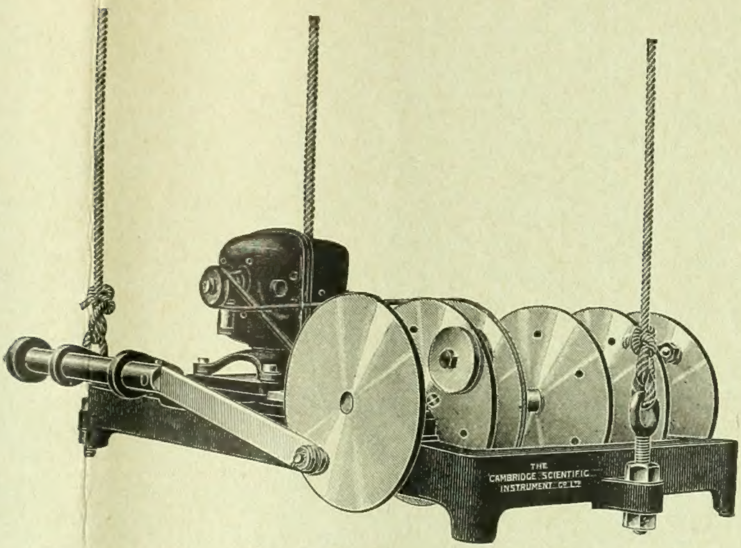
Balance of Machinery Apparatus.



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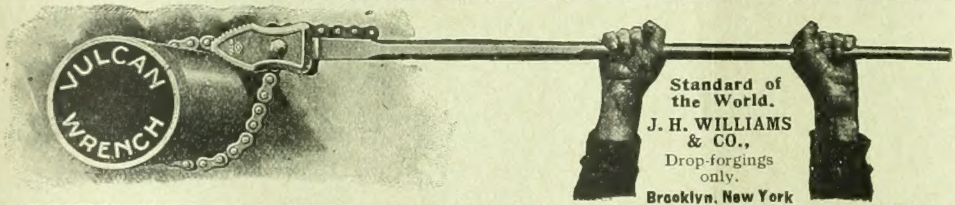

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PAGE'S WEEKLY Miscellaneous

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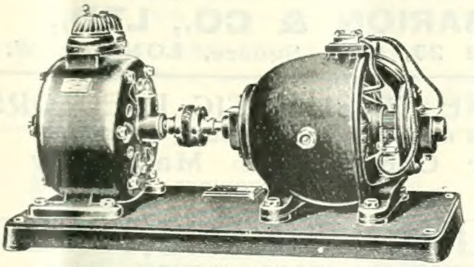

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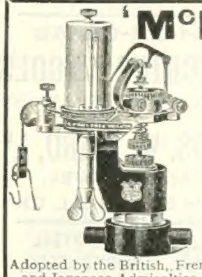

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These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
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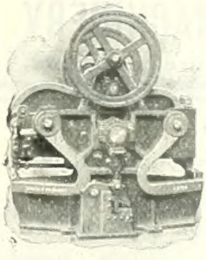

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PAGE'S WEEKLY Miscellaneous

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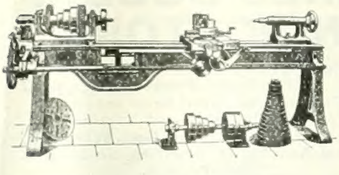

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See our Advertisement appearing Sept. 29th.

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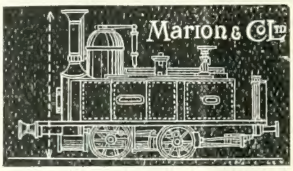

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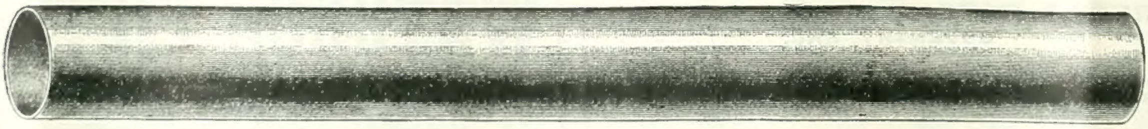

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PAGE'S WEEKLY Miscellaneous

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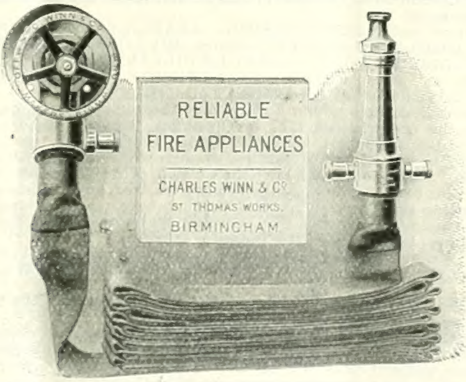

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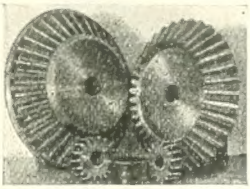

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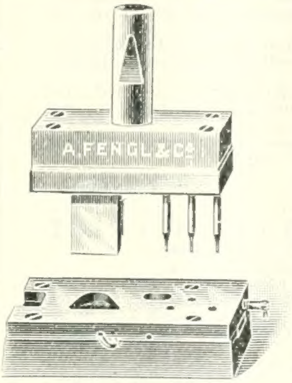

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See Next Week.

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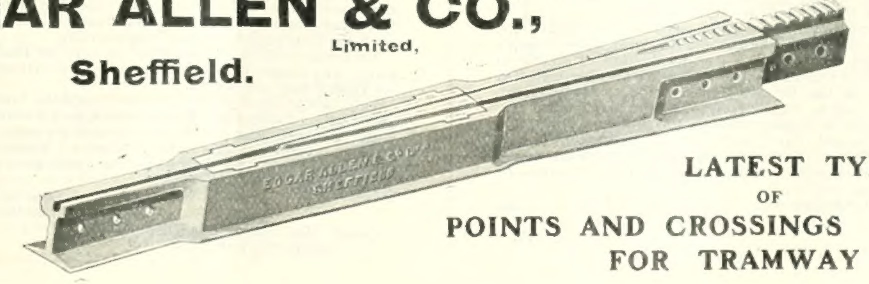

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PAGE'S WEEKLY Contracts

CONTRACTS.

THE MADRAS RAILWAY COMPANY

are prepared to receive by Twelve o'clock noon on Monday, October 2nd, **TENDERS** for the supply and delivery, free on board, of **ZINC SHEETS, TOOL STEEL, BOLTS and NUTS, MOULDERS' TOOLS, TUBE EXPANDERS, SCREW TAPS, AUGERS, TWIST DRILLS, SPLIT COTTERS, SAWS, CARRIAGE LOCKS, WINDOW CATCHES and HINGES, GAUGE GLASS, PROTECTORS, HEAD LAMPS, ENAMELLED IRON COMMODES, FIREBRICKS, CARBORUNDUM WHEELS, PLATE GLASS, STEAM PACKING, CURLED HORSEHAIR, PAINT BRUSHES, MACHINE BELTING, RUBBER PADS, TRANSFERS, and NON-CONDUCTING COMPOSITION**, as per Specifications to be seen at the Company's Offices.

Tenders to be delivered in sealed envelopes, addressed to the undersigned, endorsed "Tender for Loco. Stores," Part I. (or Part II., as the case may be).

The Directors do not bind themselves to accept the lowest or any Tender.

A charge (which cannot be refunded) will be made for each copy of the Specification.

1, Broad Street Place,
Finsbury Circus, London, E.C.
September 14th, 1905.

W. H. COLE,
Secretary.

BOROUGH OF TUNBRIDGE WELLS.

SUPPLY OF CAST-IRON PIPES. CORPORATION WATERWORKS.

The Corporation are prepared to receive **TENDERS** for the supply and delivery into their Siding adjoining the S.E. and C.R. Goods Station, Tunbridge Wells, of various **CAST-IRON PIPES** and **SPECIAL CASTINGS**, of diameters ranging from 4in. to 15 in., and amounting in all to about 420 tons, in accordance with Specification and Schedule of Quantities, copies of which may be obtained by persons desirous of submitting a *bona fide* Tender, from Mr. W. H. MAXWELL, A.M.I.C.E., Borough and Waterworks Engineer, and from whom any further particulars may be obtained.

The person or firm whose Tender is accepted will be required to enter into a formal contract and bond, with two sureties, for the due performance of the contract.

Sealed Tenders, endorsed "Cast-Iron Pipes," must be delivered to the Town Clerk's Office, Tunbridge Wells, not later than Tuesday, September 26th, at 9 a.m.

The Corporation do not bind themselves to accept the lowest or any Tender.

By Order,
W. C. CRIPPS,
Town Clerk.

Town Hall, Tunbridge Wells,
September 12th, 1905.

UXBRIDGE URBAN DISTRICT

COUNCIL, UXBRIDGE, MIDDLESEX.
WATER TOWER.—CONTRACT No. 2.
TO BUILDERS.

The above Council invite **TENDERS** for the erection of a **SQUARE BRICK WATER TOWER**, 43 ft. high to tank level, upon a site situate at Uxbridge Common, in the County of Middlesex, to carry a tank of 100,000 gallons capacity.

Specification and Forms of Tender may be obtained on and after Tuesday, the 12th inst., at the office of the Consulting Engineer, Mr. F. S. COURTNEY, M.Inst.C.E., 25, Victoria Street, S.W., on payment of Two Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Water Tower," to be delivered before Twelve o'clock on Tuesday, 26th inst., addressed to

W. T. HARVEY, Esq.,
Clerk to the Council,
126, High Street, Uxbridge.

The Council do not bind themselves to accept the lowest or any Tender.

METROPOLITAN WATER BOARD.

TENDERS FOR STEAM ENGINE AND PUMPS.

The Metropolitan Water Board invite **TENDERS** for **PROVIDING and FIXING a STEAM ENGINE, with LIFT and FORCE PUMPS** (capable of delivering 500,000 gallons of water in 24 hours), on the Board's land at the Hill Park Estate, Westerham, Kent.

Forms of Tender and Contract, with Specification and Drawings, may be obtained on application to the District Engineer, at the Board's Offices, Brookmill Road, Deptford, S.E., on production of an official receipt for the sum of Five Guineas, which sum must first be deposited with the Comptroller at the Board's Central Offices, Savoy Court, Strand, W.C., and which will be returned on receipt of a *bona fide* Tender.

Such application must be made between the hours of 10 and 4 (except on Saturdays) on and after Friday, the 1st September next.

Tenders, endorsed "Tender for Pumping Engine, Westerham, Kent," must be sent in sealed envelopes to the undersigned not later than 10 a.m. on Monday, October 2nd, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

(Signed) A. B. PILLING,
Clerk of the Board.

Office of the Board,
Savoy Court, Strand, W.C., August 29th, 1905.

THE COUNTY COUNCIL OF MIDDLESEX.

TO CONTRACTORS.

The Light Railways and Tramways Committee of the County Council of Middlesex invite **TENDERS** for the **WORK** and **MATERIALS** required in the Construction of the Permanent Way (for electric traction), Bridge Work, Road Widenings, &c., for :—

CONTRACT No. 14.

Railway No. 2 (Order 1901).—A line of double track (with cross-overs, contingent works, &c.), to be laid along Bounds Green Road in the district of Wood Green, and High Road in the district of Southgate, in the County of Middlesex, to a length of 1 mile, 5 furlongs, 1 chain, or thereabouts.

The Plans, Conditions of Contract, Specifications of Works, &c., for this Contract may be seen, and Schedules of Quantities obtained by intending contractors (on payment of £10, which will be returned on receipt of a *bona fide* Tender) on application at my offices between office hours on and after Monday, September 18th, 1905.

Tenders, properly sealed and endorsed "Tender for Light Railway, No. 2," to be delivered to Sir RICHARD NICHOLSON, Clerk of the County Council, Middlesex Guildhall, Westminster, S.W., on or before October 4th, 1905.

The County Council does not bind itself to accept the lowest or any Tender.

H. T. WAKELAM, M.Inst.C.E.,
County Engineer.

Middlesex Guildhall,
Westminster, S.W., September 7th, 1905.

TO ENGINEERS AND OTHERS.

THE METROPOLITAN ASYLUMS

BOARD invite **TENDERS** for **NEW BOILERS and BOILER-HOUSE PLANT, NEW LAUNDRY MACHINERY and REVISIONS to LAUNDRY PLANT**, also **NEW STEAM MAIN**, &c., at the Eastern Hospital, Homerton, N.E., in accordance with Drawings and Specification prepared by Mr. W. T. HATCH, M.I.C.E., M.I.M.E., Engineer-in-Chief.

Drawings, Specification, Conditions of Contract, and Form of Tender, may be inspected at the office of the Board, Embankment, E.C., on and after Wednesday, September 13th, 1905, and can be obtained upon payment of a deposit of £2.

The amount of the deposit will be returned only to persons who have sent in *bona fide* Tenders and returned Drawings and Specification in accordance with the regulations.

Tenders, addressed as noted on the form, must be delivered at the office of the Board not later than 10 a.m. on Tuesday, October 3rd, 1905.

By order,
T. DUNCOMBE MANN,
Clerk to the Board.

September 6th, 1905.

COUNTY OF LONDON.

TO ELECTRIC CABLEMAKERS.

The London County Council invites **TENDERS** for the manufacture and laying of

(*a*) 56 miles **LOW-TENSION, LEAD-COVERED, PAPER-INSULATED CABLES**, 20 miles **DRY-CORE TELEPHONE CABLES, CAST-IRON FEEDER PILLARS**, &c., &c.

(*b*) 24 miles **EXTRA HIGH-TENSION 3-CORE, LEAD-COVERED, PAPER-INSULATED CABLES**, &c.

Persons desiring to submit Tenders may inspect the Drawings and obtain the Specifications, Bills of Quantities, Forms of Tender, and other particulars at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of Two Pounds for each Section. This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the Tenderer, provided he shall have sent in a *bona fide* Tender and not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the Work may be obtained on application at the County Hall previously to the payment of the fee for the Specification, &c.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The Contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Low-Tension Cables, &c.," and "Tender for High-Tension Cables, &c.," respectively.

No Tender will be received after 10 a.m. on Tuesday, October 3rd, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept any Tender which is not strictly in accordance with the Specification, or the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk to the London County Council.

County Hall, Spring Gardens, S.W.,
September 13th, 1905.

PAGE'S WEEKLY Contracts and Appointments Open

UPTON-ON-SEVERN RURAL DISTRICT COUNCIL.

UPTON-ON-SEVERN WATER.—CONTRACT No. 1.

The above Council invite **TENDERS** for **SINKING** and **BORING** a WELL to a depth of 900 feet or thereabouts.

Specification and Schedule of Prices may be obtained at the offices of the Engineers, Messrs. WILCOX AND RAIKES, 63, Temple Row, Birmingham, on or after September 4th, on payment of a deposit of Five Guineas, which will be returned on receipt of a *bona fide* Tender and the return of all documents.

Sealed Tenders, with Schedule of Prices filled in on the form supplied, and endorsed "Upton-on-Severn Water Supply," must be delivered at my office not later than September 26th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
G. H. T. FOSTER, Solicitor and Notary,
Clerk to the Council.

Church Street, Upton-on-Severn,
August 31st, 1905.

EAST INDIAN RAILWAY.—The East

Indian Railway Company is prepared to receive **TENDERS** for the SUPPLY and DELIVERY of

ELECTRIC PLANT and MATERIALS,

as per specification to be seen at the Company's offices.

Tenders are to be sent to the undersigned, marked "Tender for Electric Plant and Materials," not later than Twelve o'clock noon on Wednesday, the 27th day of September instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each Specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.
September 14th, 1905.

URBAN DISTRICT OF HORSFORTH.

WATERWORKS.

The Urban District Council of Horsforth invite **TENDERS** for the CONSTRUCTION and ERECTION of a SUCTION GAS PRODUCING PLANT and GAS ENGINE capable of producing 32 Brake Horse-power, for the purpose of driving a Bore Hole Pump for the Horsforth Waterworks at Scotland Lane, Horsforth.

A plan of the general arrangement of the machinery can be seen, and copies of the General Conditions, Specification, and Tender can be obtained at the offices of the Engineer, Mr. E. J. SILCOCK, M.Inst.C.E., 10, Park Row, Leeds.

Sealed Tenders, endorsed "Gas Engine," must be delivered to the undersigned not later than noon, Monday, October 16th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
ROBT. R. JONES,
Clerk to the Council.

Council Offices,
Horsforth, near Leeds,
September 13th, 1905.

URBAN DISTRICT OF HORSFORTH.

WATERWORKS.

The Urban District Council of Horsforth invite **TENDERS** for the CONSTRUCTION and ERECTION of a BOREHOLE PUMP, capable of lifting 9,000 gallons per hour from a depth of 350 ft., for the Horsforth Waterworks, at Scotland Lane, Horsforth.

A plan of the general arrangement of the machinery can be seen, and copies of the General Conditions, Specification, and Tender can be obtained at the offices of the Engineer, Mr. E. J. SILCOCK, M.Inst.C.E., 10, Park Row, Leeds.

Sealed Tenders, endorsed "Borehole Pump," must be delivered to the undersigned not later than noon, Monday, October 16th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT R. JONES,
Clerk to the Council.

Council Offices,
Horsforth, near Leeds,
September 13th, 1905.

CHISWICK URBAN DISTRICT COUNCIL.

Persons desirous of Tendering for the Wiring of Refuse Destructor and other Buildings, Underground Services and Overhead Supply to Outside Lights at the Sewage Disposal Works, Corney Reach, Chiswick, may obtain Specifications and Forms of Tender from Messrs. SWINBURNE, COOPER, AND BAILLIE, the Council's Consulting Engineers, 82, Victoria Street, Westminster, S.W., upon deposit of £1, returnable on receipt of a *bona fide* Tender. Tenders to be delivered at the Engineers offices as above, not later than 12 o'clock noon on Friday, the 29th September, 1905.

Dated this 8th day of September, 1905.

ERNEST F. COLLINS,
Clerk of the Council.

Town Hall, Chiswick, W.

UXBRIDGE URBAN DISTRICT COUNCIL, UXBRIDGE, MIDDLESEX.

WATER TANKS AND MAINS.—CONTRACT No. 3.

TO ENGINEERS.

The above Council invite **TENDERS** for the **SUPPLYING** and **ERECTING** of a **CIRCULAR STEEL TANK** of 100,000 gallons capacity, together with all Pipe Connections thereto. Also the Supplying and Laying of 2,370 yards of 6-in. Cast-iron PUMPING and SERVICE MAIN with Connections, &c., and Alterations to Existing Mains.

Specification and Forms of Tender may be obtained on and after Tuesday, the 12th instant, at the office of the Consulting Engineer, Mr. F. S. COURTNEY, M.Inst.C.E., 25, Victoria Street, Westminster, S.W., on payment of Two Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tank and Mains," to be delivered before Twelve o'clock on Tuesday, 26th instant, to

W. T. HARVEY, Esq.,
Clerk to the Council.

126, High Street, Uxbridge.

The Council do not bind themselves to accept the lowest or any Tender.

APPOINTMENTS OPEN.

HERIOT WATT COLLEGE, EDINBURGH.—ENGINEERING DEPARTMENT.

Applications are invited for the post of **CHIEF INSTRUCTOR** in MACHINE DESIGN and WORKSHOP SUPERINTENDENT.

Drawing office and workshop experience essential.

Salary not less than £165 per annum.

Applications to be sent not later than 25th September, to the Principal of the College, from whom further particulars may be obtained.

PETER MACNAUGHTON, S.S.C.,
Clerk.

Heriot Trust Offices,
20, York Place, Edinburgh,
September 8th, 1905.

URBAN DISTRICT COUNCIL OF WANTAGE.

SURVEYOR AND SANITARY INSPECTOR.

The Council invite applications for the appointment of Surveyor, Sanitary Inspector, and Collector of Rates for the district. The salary will be £130, with prospect of increase to £150 on the death or resignation of the Assistant Surveyor.

Applications, stating age and previous experience, and accompanied by copies of not more than three testimonials of recent date, to be sent to me on or before the 30th inst.

EDWD. B. ORMOND,
Clerk to the Council.

Wantage, Berks,
September 11th, 1905.

NEW ZEALAND.—The Technical

Education Board of Wellington, New Zealand, invite applications for the appointment of INSTRUCTOR in ENGINEERING. Salary, £300 and £40 passage allowance.—For further particulars, and for forms on which the application must be made, apply to the HIGH COMMISSIONER FOR NEW ZEALAND, 13, Victoria Street, London, S.W.

LAGOS GOVERNMENT RAILWAY EXTENSION.

ENGINEERS (Senior and Junior) required immediately on the above railway.

Candidates must be between the age of 25 and 45.

Previous experience on railway survey essential.

Date of sailing, September 30th.

Salary from £25 to £50 per month, with free passage out and home, and liberal leave allowance.

Applications, giving full particulars of experience and names and addresses of references, and enclosing copies (not originals) of testimonials, to be addressed to

Messrs. BAKER and SHELFORD,
35a, Great George Street,
Westminster, London.

Applications to be marked "Survey."

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Boiler and Crank Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, Lond W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 16, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wire Ropeways

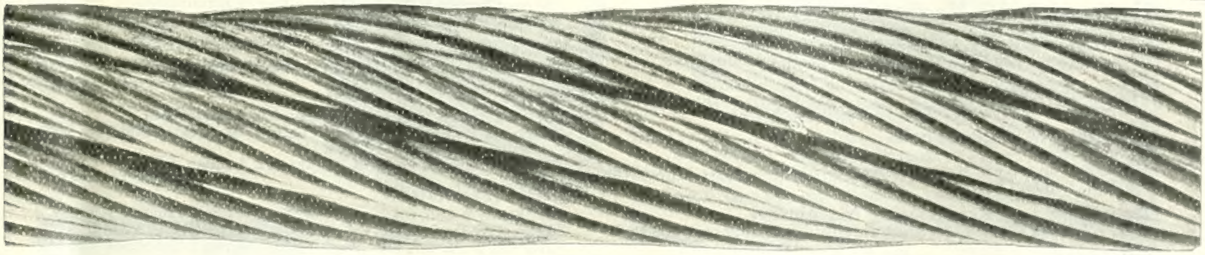
RESULT OF A TEST

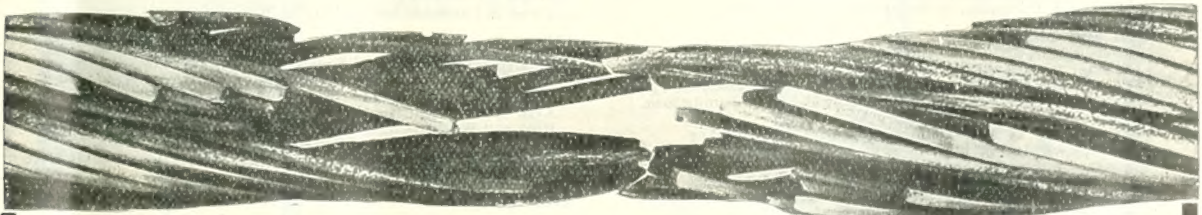
OF ONE OF

BULLIVANTS' STEEL WIRE ROPES

AFTER WORKING $3\frac{3}{4}$ YEARS.

This rope **WHEN NEW** measured $5\frac{1}{4}$ in. circ. and took a breaking strain of 104 TONS. SAME ROPE (STILL IN USE) after working continuously for $3\frac{3}{4}$ YEARS hauling heavy trains up an incline of 1 in 12, during which time it ran 58,000 MILES, and had reduced in size to $4\frac{7}{16}$ in. circ., **WHEN TESTED** took a breaking strain of 85 TONS 17 CWT.





WIRE ROPES FOR CRANES, LIFTS, HOISTS, DERRICKS, AND ALL PURPOSES.

BULLIVANT & CO., LTD.,

REGD. OFFICE: **72, Mark Lane, London.** WORKS: **Millwall, E.**

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Consolidated Pneumatic Tool Co., Ltd, Palace Chambers, 9, Bridge Street, Westminster, S.W.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund. Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin. Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rookwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

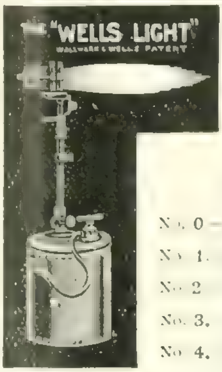
Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED

Horizontal Flame Unaffected by Weather

OVER 18,000 SOLD

		PRICE COMPLETE.
No. 0	— 500 Candles, small hand pattern for petroleum	£7 7 0
No. 1.	1500 Candles, hand pattern with No. 2 burner for Tar Oil	£10 0 0
No. 2	1500 Candles, useful and portable pattern	£15 10 0
No. 3.	2500 Candles, Manchester Ship Canal pattern ..	£16 10 0
No. 4.	3000 Candles. A most powerful lamp ..	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries, but in Great Britain our Special Wells Oil is supplied which is half the price, and gives 30 per cent. more light. Special prices for our [illegible] can be had on application to our Agents or direct to us.

No. 50 "STANDARD" LAMP.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from [illegible] paraffin or petroleum. The reservoir holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

WELLS' STANDARD OIL GAS LAMP NO 50

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/- each
Double	19/- "
Tripod Stands	3/- "
Extra Burners	2/- "

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air receivers or from our special Compressors.

No. 1 Painter (as shown in Illustration)	£25 0 0
No. 2 "	£30 0 0
No. 3 "	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS,

Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

Price, Complete £16

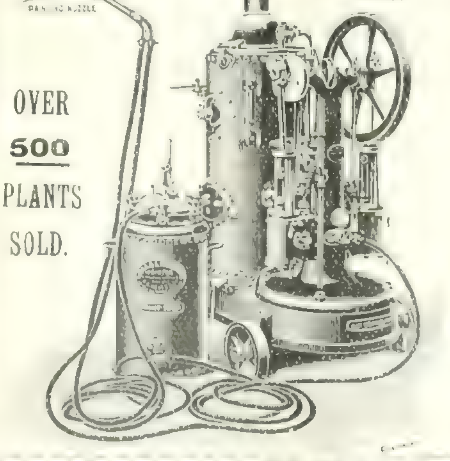
Hand Sprayer and Hose supplied separately, £9.

Supplied to 12 Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.

No. 2 Painter, extra £30.



OVER **500** PLANTS SOLD.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

LONDON, N.W.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22 and 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
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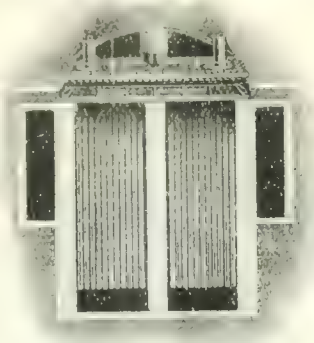

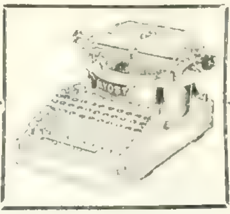

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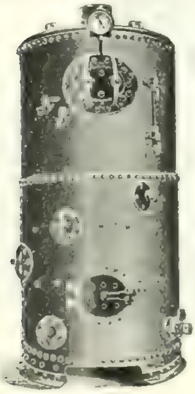

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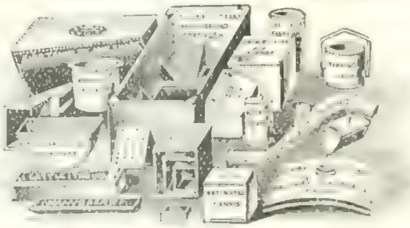

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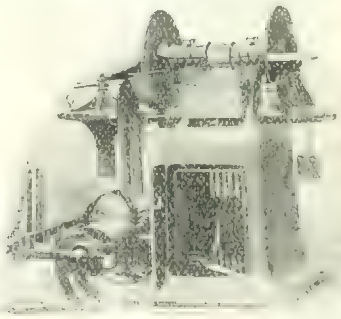

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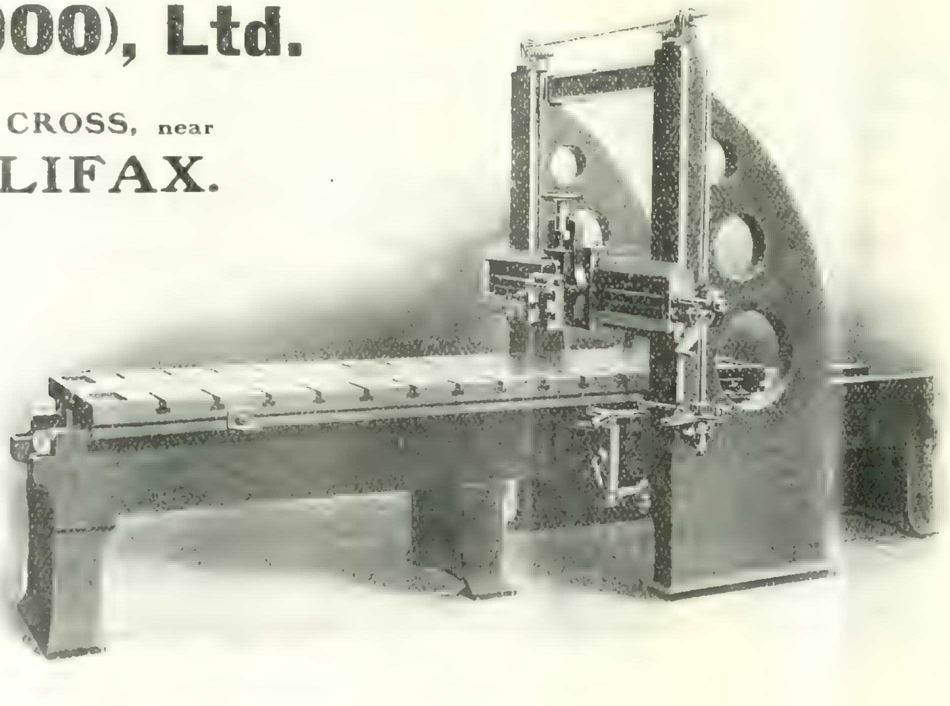

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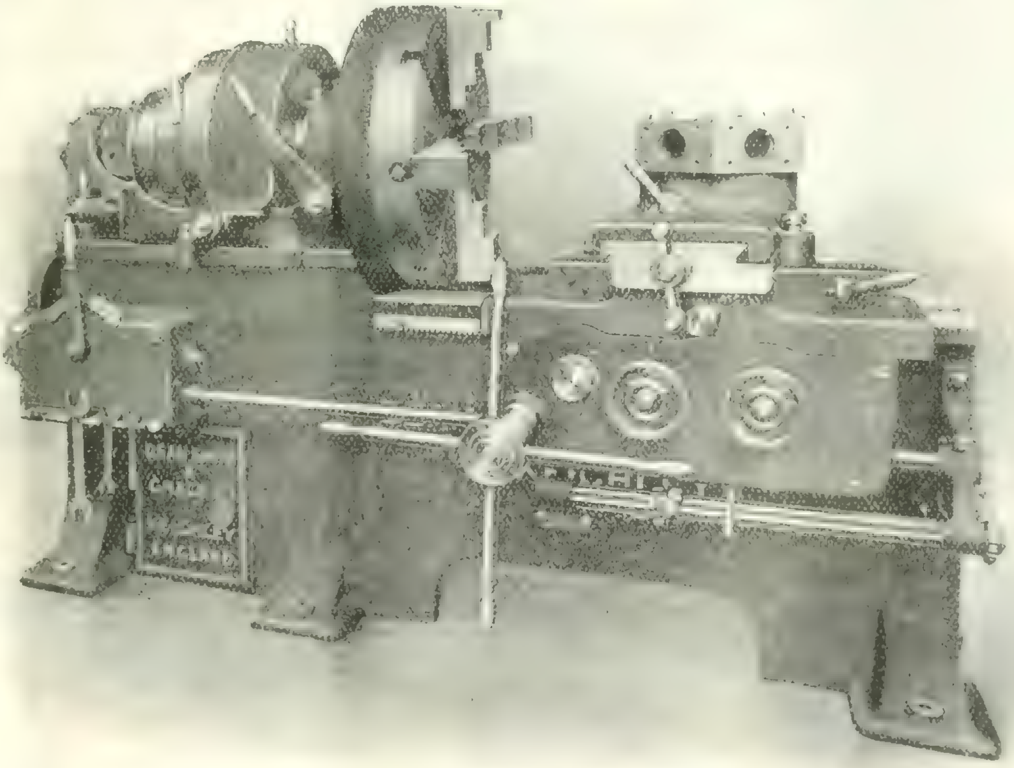

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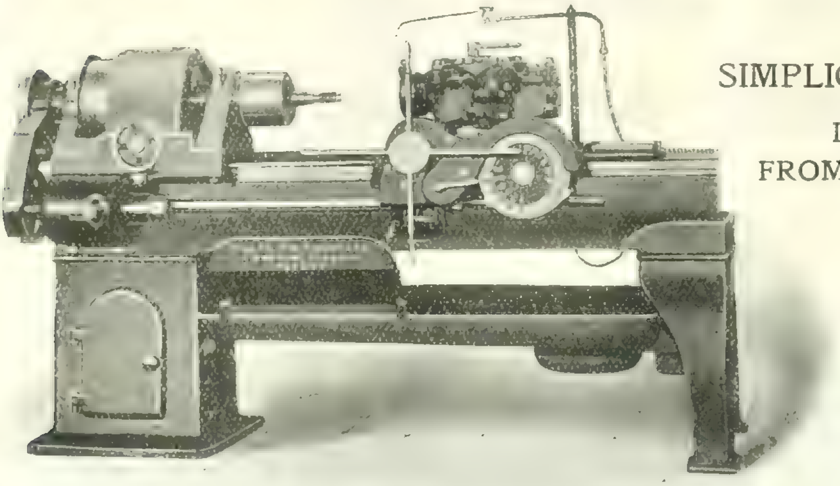

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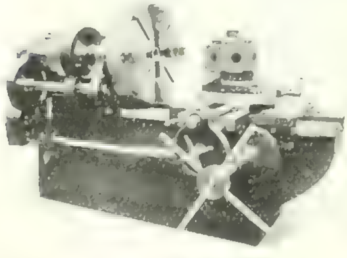

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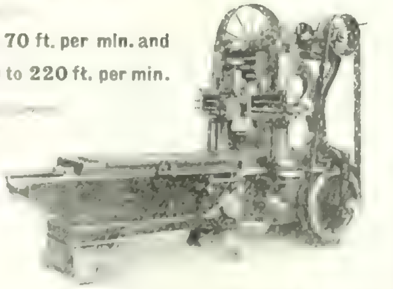

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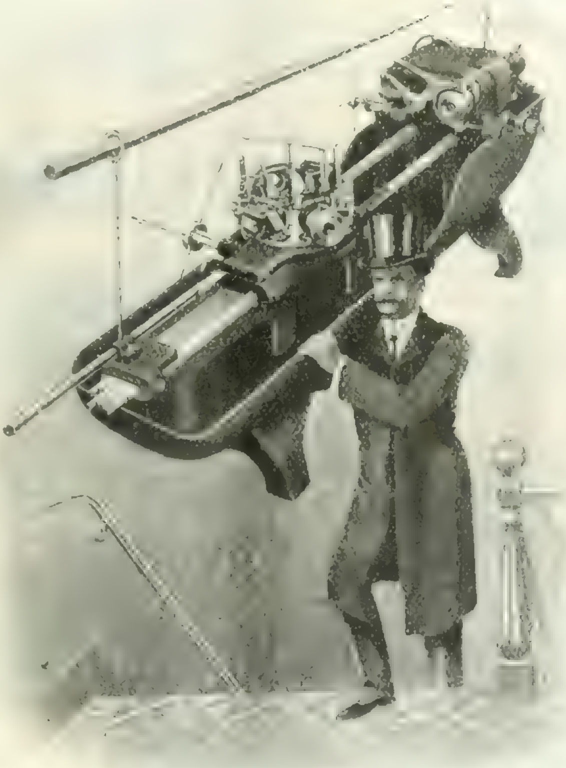

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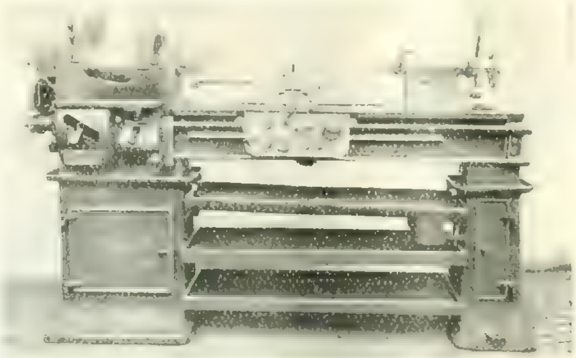

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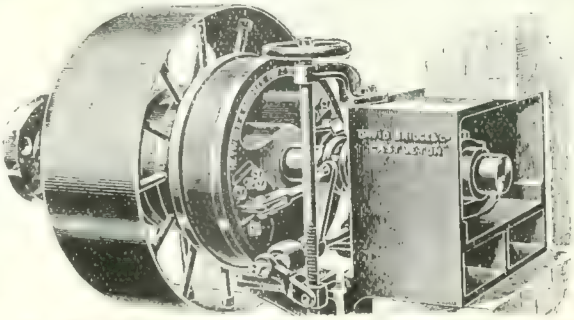

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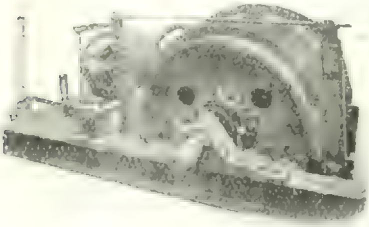

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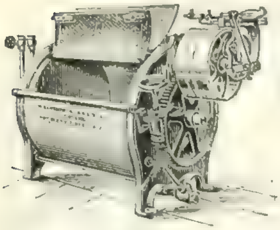

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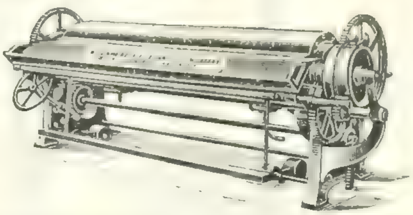

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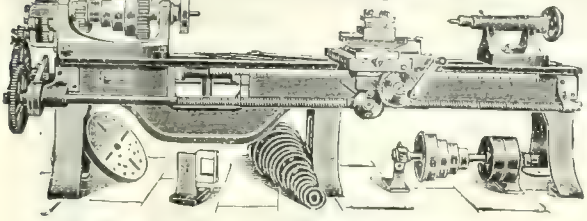

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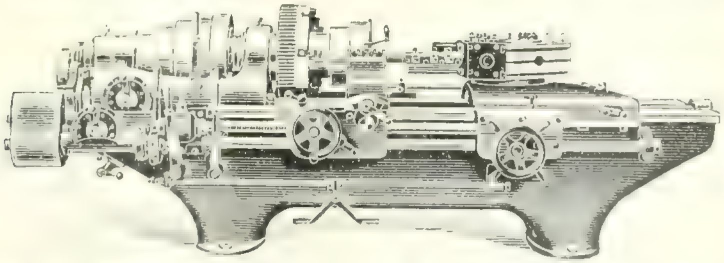

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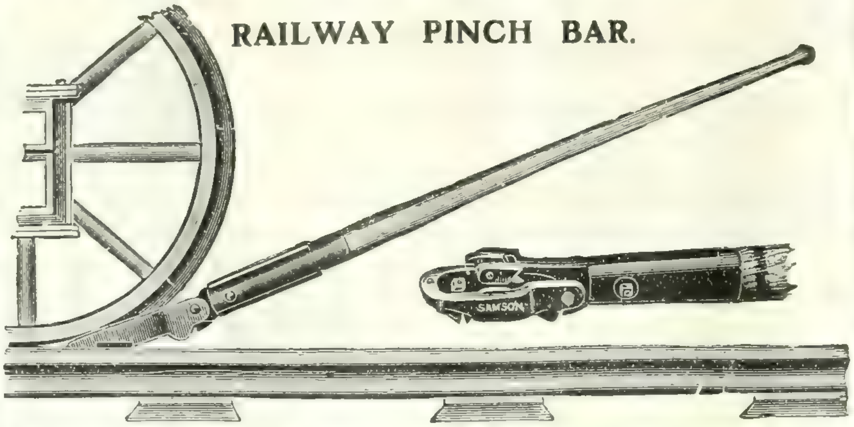

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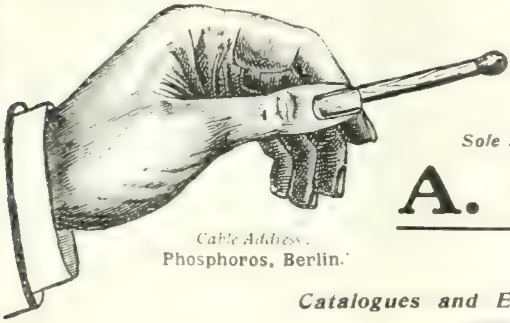

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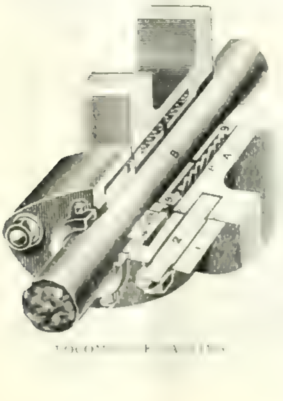

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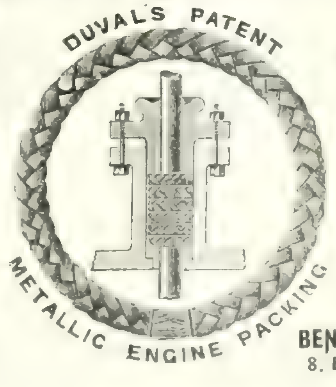

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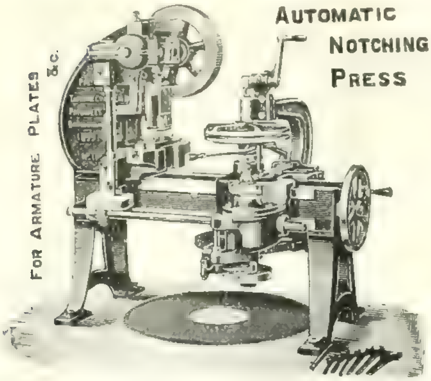

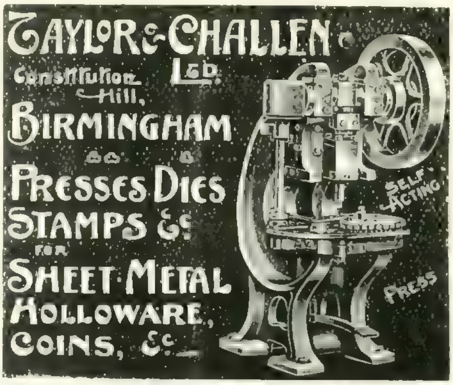

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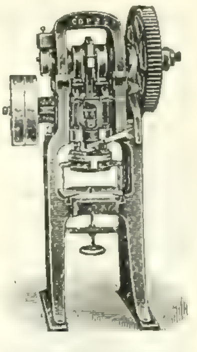
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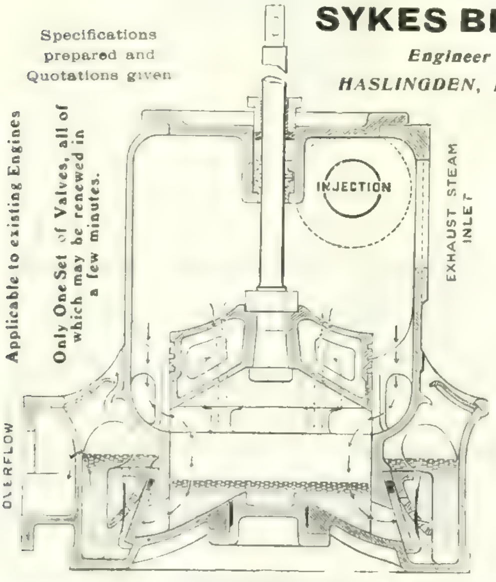

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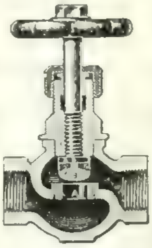

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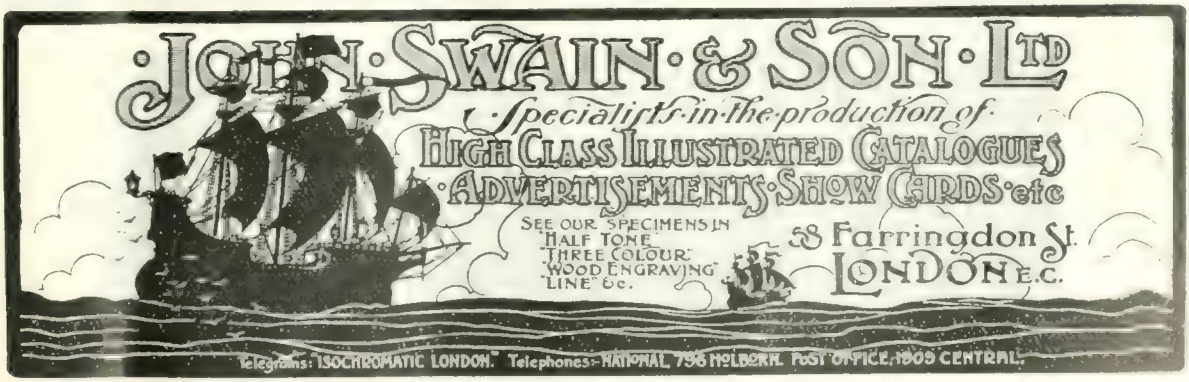
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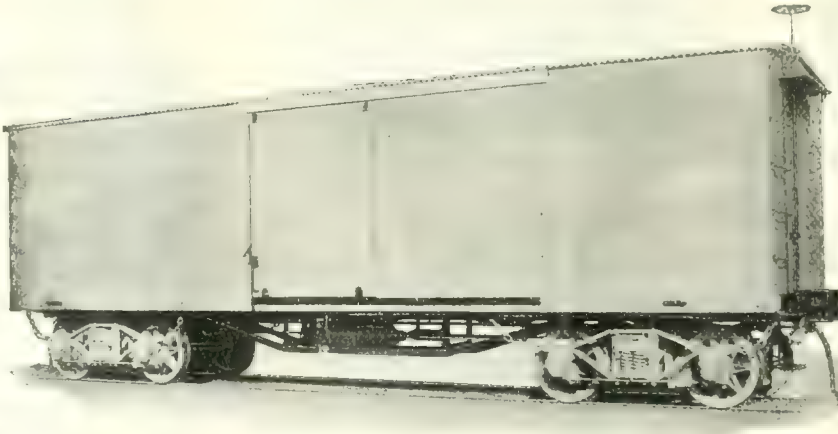

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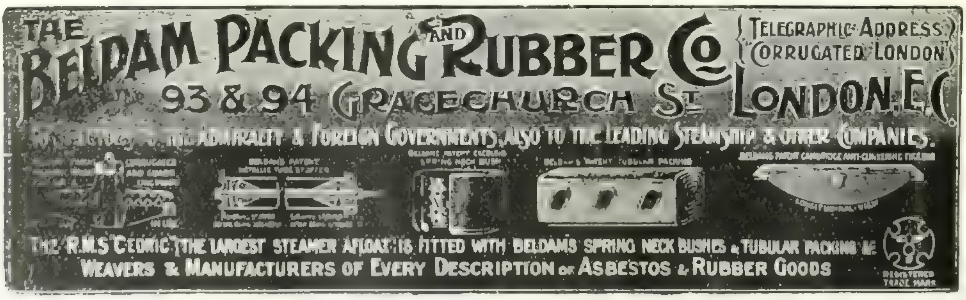

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, SEPTEMBER 22, 1905. No. 54.

The Offices of "Page's Weekly," Wednesday Evening.

IN view of the growth of electric traction in crowded centres of population, and the high speed of which the electric cars now in service are capable, more than ordinary interest attaches to the exhaustive series of brake tests which are being carried out by the tramway officials of the London County Council under the direction of Mr. A. L. C. Fell, with a view to determining the best form of existing brake. The trials are being carried out on cars run at high speed over the County Council system, at night or early morning, when the roads are fairly free from other traffic, and although the investigations are not yet completed, and no actual figures are now available, the character of the trials being made, indicates that the report when it is issued, will be an authoritative pronouncement on a subject of growing importance. The brakes being tested are those of the Westinghouse and British Thomson-Houston companies. It is evident that the demonstration of a really effective brake, such as would enable cars to be effectively controlled in London traffic, would be the prelude to the sanction of the Board of Trade to an increase of speed above the statutory twelve-mile limit. An application has already been made to that Department for the necessary permit, and indeed it is understood that a Board of Trade official has been present at some of the trials made. Whether this implies official sanction to a speed of 14 or 16 miles an hour cannot be said at this juncture, for the workings of the official mind are usually "wropt" in mystery. It is hoped the report on the brake tests will be published at an early date, and Mr. Fell has promised to contribute a paper on the subject to the Tramways and Light Railways Association.

E. CUNLIFFE-OWEN, C.M.G.,

Chairman of the Executive Committee of the Electrical Exhibition, who is expected to respond to the Lord Mayor's toast at the inaugural luncheon following the opening of the Exhibition at Olympia on Monday next.

The accompanying table illustrates in a striking manner the economies which resulted from the introduction of compressed air plant at the Gray Cañon Quarry of the Cleveland Stone Company at North Amherst, Ohio—the largest sandstone quarry in the world. In the course of a recent paper in the Engineering and Mining Journal, Mr. Lucius I. Wightman describes the circumstances under which the old steam plant came to be superseded. For years steam-driven mills, pumps and hoists were supplied from scattered boiler plants; channellers and drills drew their steam from a host of small portable boilers, and over all brooded the darkness of vapour and smoke. Various conditions combined to produce an appalling steam consumption which was rendered still more discouraging by the heavy fuel cost. As a crisis seemed near, the management looked around for a remedy, and compressed air was decided upon.

The power plant installed is centrally located, and is said to represent the highest attainment in steam and pneumatic practice. Steam is generated at 180 lb. pressure in four water-tube boilers, equipped with mechanical stokers and induced draught, and aggregating a trifle over 1,000 boiler horse-power. As originally installed, for the Gray Cañon alone, only three of these boilers were in place; the fourth was added when extra load came upon the system. Feed and circulating pumps—in fact, all auxiliaries—are of standard types. Two air-compressing units are installed; they are steam-driven cross-compound-condensing two stage Corliss machines, with positive air-thrown air valves. At a rate of speed of 90 revolutions per minute, with air at 100 lb. pressure and steam at 165 lb., each unit indicates about 1,000 h.p. and has a piston displacement of 6,030 cubic feet of free air per minute. Compound steam-driven jet condensers handle the engine exhaust, drawing condensing water from an extensive system of cooling trays outside the power-house. Reheating steam receivers, between high and low-pressure steam cylinders of the main units receive also the exhaust from the condenser engines. Air cylinders are completely water-jacketed; inter-coolers and after-coolers are introduced at proper stages. The power plant in every detail is designed to secure minimum cost.

Mr. Wightman further records that from the main primary receiver just outside the power-house a loop system of air-pipe distribution covers the entire working of the Gray Cañon. This five-loop system secures great carrying capacity at low cost, avoids any measurable drop in pressure, gives the maximum discharge without drop on any branch, and permits the repair or alteration of any section without crippling or affecting the remainder of the system. It is a scheme of great flexibility. Frequent offsets properly care for expansion and contraction, proper supports relieve the lines from sagging strains. Ample provision is made, by tees and valves, for the attachment of new branches as the active zone shifts about. The work is so carefully laid out and adjusted that the loop system, as a whole, holds its working pressure for twelve hours. The plans called for the continued use as far as possible of the old appliances under the new system.

The bane of compressed air in expanding engines has been the freezing at exhaust ports. Mr. Wightman mentions that at the Gray Cañon plant this trouble was anticipated and provided for. A large part of the entrained moisture is condensed and collected in the inter-coolers and after-coolers; another portion finds lodgment in the primary receiver. From this point the lines grade to secondary receivers, where the condensation of the entire line is collected and removed through cocks. So perfect is this system for removing moisture that the plant was operated for weeks in freezing weather without reheaters and with no freezing whatever.

The success of the compressed air plant at the Gray Cañon was so marked that two neighbouring quarries became interested. Their investigations led to an extension of the air system to the Malone and Mussey quarries, distant, respectively, about 2,000 and 2,200 feet from the power plant. The only addition necessary at the power-house was the fourth boiler, already noted, and a second primary receiver from which the new pipe-line leads. The present equipment of four boilers, aggregating 1,028 boiler horse-power, has replaced 49 isolated boilers, with a combined capacity of 1,800 boiler horse-power.

An examination of the table shows that with air as a power, the number of active machines was reduced from that of the old system; yet the output of the quarry has been increased since the new plant was installed. This apparent paradox is due principally to the increased constant pressure and the increased activity of the air.

Mr. George H. Winstanley, F.G.S., M.I.M.E., who recently gave the members of the Institution of Mining Engineers an account of the scheme of mining education adopted at Manchester University, is joint editor with Mr. F. Percy, M.I.M.E., A.M.I.Mech.E., of the last literary effort of the late C. M. Percy, F.G.S., M.I.M.E., just issued from the press and published by Collins and Kingston of Manchester. Rarely does an editor find himself in such close relationship to his author as Messrs. Percy and Winstanley, the one being an only son and the other a close colleague. The work in question is entitled "The Mechanical Equipment of Collieries," and comprises upwards of 600 pages, with more than 400 illustrations. Mr. C. M. Percy's long and varied experience in colliery engineering, and his widepread popularity as an authority and writer on engineering matters, are a sufficient guarantee that the subject is dealt with in a thoroughly efficient manner. We have not yet seen the volume, but are assured that it is calculated to prove of great value to mining students, mining engineers and colliery managers.

—	1903.	April.	June.	1904.	April.	June.
		Gray Cañon	Mussey and Malone.		Gray Cañon	Mussey and Malone.
	Tons. Dols.	Dols.	Dols.	Tons. Dols.	Dols.	Dols.
Coal consumption	50 at 2·00 20 ,, 2·00	100·00	40·00	[illegible] at 1·60 10 ,, 1·60	24·50	16·00
Labour and attendance at channellers	16 ,, 10·00 7 ,, 10·00	160·00	70·00	12 ,, 10·00 5 ,, 10·00	120·00	50·00
Labour and attendance at drill	15 ,, 3·00 6 ,, 3·00	45·00	18·00	9 ,, 3·00 4 ,, 3·00	27·00	12·00
Firemen at hoists	9 ,, 1·25 3 ,, 1·25	11·25	3·75	—	—	—
Firemen at pumps and drill boiler	2 ,, 1·25 2 ,, 1·25	2·50	2·50	—	—	—
Firemen at mills 12-hour shift	2 ,, 2·00 2 ,, 2·00	4·00	4·00	—	—	—
Pipe repair gang	—	5·00	2·50	—	—	—
Locomotive repair and rental	—	10·00		—	—	—
Coal for re-heater	—	—			1·00	—
Total costs per day		337·75	140·75		172·50	78·50
Total saving per day	—	165·25	62·25	—	—	—

Aggregate saving per day, 227·50 [illegible]

TABLE ILLUSTRATING SAVING BY COMPRESSED AIR PLANT.

We are glad to note that the Local Government Board have issued an order permitting of a further variation in the provisions of the Highways and Locomotives Amendment Act, so as to authorise the use on highways of locomotives, the driving wheels of which are fitted with the Pedrail. This action has been taken after communicating with a number of bodies representative of the local authorities concerned, and after considering the various suggestions made to them on points of detail. One of the chief difficulties which Mr. Diplock, the inventor of the pedrail, has had to contend with has been the impossibility of getting a licence for an extended trial on the road, owing to the Locomotives Acts never having contemplated walking machines. It was only by obtaining an order from the War Office making it a Government trial that he was enabled to get a run from Lincoln to London last November. During the first two days of the trial referred to, the defects which manifested themselves were confined to the water lifter and pump, etc. It was not until the third day that anything went wrong with the pedrails, and then only matters of detail, which did not prevent the continuance of the run to London; and we hear that in his latest design the inventor has rendered their recurrence impossible. It will be remembered that the trial from Lincoln to London, extending over a week, was attended throughout by one of the chief inspecting engineers of the Local Government Board, and the subsequent granting of the order speaks for itself.

Two workmen in Johannesburg were recently engaged in discussing the British Association. One of them was overheard to say, "I have not seen them yet. When do they play?" Light was only thrown upon this somewhat cryptic remark when it transpired that the gentleman who made it thought the Association was a football team. Since then a deal of m[illegible] doubtless been [illegible] on both sides. There has even been an exchange of thought with the natives. The members during their visit went down to the roots of ethnology by witnessing a native wedding, and there is probably not a learned professor among them who could not tell us exactly how many head of cattle the fortunate bridegroom had to pay for his dusky bride—a matter which, after all, is just as important in its way as the manufacture of diamonds or the consideration of steel as an igneous rock.

Perhaps the correct answer to the Johannesburg query would have been that members of learned associations, at meetings of this description, play for the greater part of the time. Most people know that except for the serious few these meetings are a species of gigantic picnic. They may, and generally do, begin with a flourish of pow-wow and a vigorous application of civic drums. The president may open up with remarks upon the intimate constitution of matter, but everybody knows that business will soon be concerned with the intimate constitution of turtle soup. In short, the members set out with the intention of having a "good time," and as regards the South African meeting of the British Association, everything points to the fact that they have had it. The party left for England on the 20th inst.

Even the usually staid Reuter seems to have received a marked impression of the festive side of the South African visit of the British Association. Their correspondent at Beira chronicles the fact that "The embarkation of the members of the Association on board the steamer *Durham Castle* was like the setting out of a warlike expedition. Almost every man and woman was armed with tomahawks, spears, assegais, shields, knobkerries, and many were also laden with every kind of trophy, skins and heads of game, horns, ostrich eggs, sjamboks, native musical instruments, and even birds' nests."

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

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NEWS ITEMS.

[illegible] have arrived at the Royal Naval College, Dartmouth.

The Electrical Exhibition opens on Monday at Olympia. A preliminary notice of some of the exhibits will be found at page 625.

The gold produced in the Transvaal during August amounted to 428,581 oz., valued at £1,820,496, an increase of 9,676 oz., on the previous month.

Owing to the recent heavy rains in the Elan Valley, Birmingham is now for the first time getting its water-supply entirely from Wales, under the new system.

Professor Ayrton's estimate of the power potential of the Zambesi Falls, with their present mean flow, is stated to be only 580,000 h.p., compared with the available 3,000,000 of Niagara.

The dates of the ordinary general meetings of the Institution of Electrical Engineers for the session [illegible], have been fixed as follows:—[illegible] November [illegible] and 23rd; December [illegible] and 14th. [illegible] January [illegible] and 25th; February [illegible] and 22nd; March 8th and 22nd; April 5th and 26th; May 10th and 24th.

The fifty-ninth session of the Institution of Engineers and Shipbuilders in Scotland will be opened on the evening of October 24th, when the president, Mr. James Gilchrist, will deliver an address, which will be followed by the reading of a paper on "The Determination of the Principal Dimensions of the Steam Turbine, with special reference to Marine Work," by Mr. E. M. Speakman.

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A Useful Boiler-House Accessory.

The importance of the part played by the atmosphere in furnace combustion is too well-known to be insisted upon. It has been over and over again demonstrated that a good or faulty regulation of dampers will make a vast difference to the coal bill. Unfortunately, it has not always been easy to keep a check on the stokers, especially during the night, and those who have experienced difficulty in this direction will welcome the recording instrument which, under the name of the Phœnix Recording Draught Gauge, has been put on the market by Messrs. Sanders, Rehders and Co., of 108, Fenchurch-street, E.C.

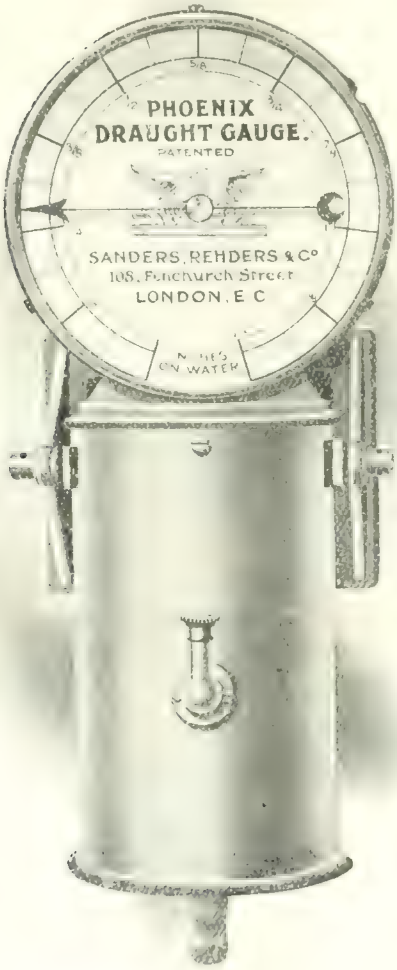


FIG. 1. THE PHŒNIX DRAUGHT GAUGE.

The dial guage shown in fig. 1, is mounted on the front of the boiler in a prominent position. A bell floating on glycerine is enclosed in the body of the instrument, which is in communication with the outside atmosphere. A tube, connected with the boiler flue by means of a gas pipe enters at the bottom of the instrument and is carried under the bell. The draught from the chimney creates a partial vacuum under the bell, which is forced down by atmospheric pressure. This motion, as well as the slightest deviation in the draught are transmitted accurately to the dial by means of a small circular rack, and pinion.

Thus in a short time the stoker can ascertain the minimum draught with which he can work satisfactorily and will adjust his dampers accordingly.

The recording instrument which forms part of the apparatus is shown in fig. 2. It automatically and continuously registers on a chart the exact draught with which the stokers are working, and also affords a reliable means of controlling the periods of stoking and cleaning.

As the makers point out, this is of the greatest importance, as some stokers are wont to fire heavily at long intervals, thus either admitting more air than required, which means a loss of heat, or else producing black smoke until the fire is burned through.

At the Hibernia Coal Mines, no less than nineteen of these draught gauges are in use.

Canadian Mining Developments.

The Toronto correspondent of the Iron Age says that a new problem in metallurgy has been raised by the discoveries out of which the new town of Cobalt has grown in the Temiskaming mining district. Ores discovered at this point on the Temiskaming and Northern Ontario Railroad are remarkable for their composition. They contain cobalt, silver and nickel, along with other minerals, in an admixture that is seldom met with. Not only are they remarkable for the association of minerals not often found together, but they are even more notable for the richness of their silver and nickel contents. Much has yet to be proved, but the opinion is quite freely expressed that there is no other place in the world where silver averages so large a proportion of the ore. The nickel content is likewise extraordinary. So exceptional is the problem these deposits present that the Provincial Government has at last decided to withdraw from sale or lease the four townships in which the veins are traced. This step is taken preparatory to the devising of a scheme for the better administration of the deposits in the public interest. Indeed the newspapers maintain that the country might as well be without these rich deposits if the province is not to derive some revenue from them, for it is pointed out the benefit of their development goes almost wholly to foreigners. In the town of Cobalt a very large proportion of the population is made up of miners and prospectors from fields in other countries, notably the United States. The ores are shipped for treatment to the United States, for there is no suitable refinery in Canada.

It has just been announced that the Canadian Copper Company has completed arrangements to enter the market as a purchaser of the ores. A crusher is being erected. The ore will be roasted in retorts to rid it of the arsenic, which is present in large percentages. Then it will be smelted in the ordinary way. The refining will continue to be done in New York.

This action of the Canadian Copper Company may operate to prevent another development for which there is some demand, namely the establishing of a Government smelter.

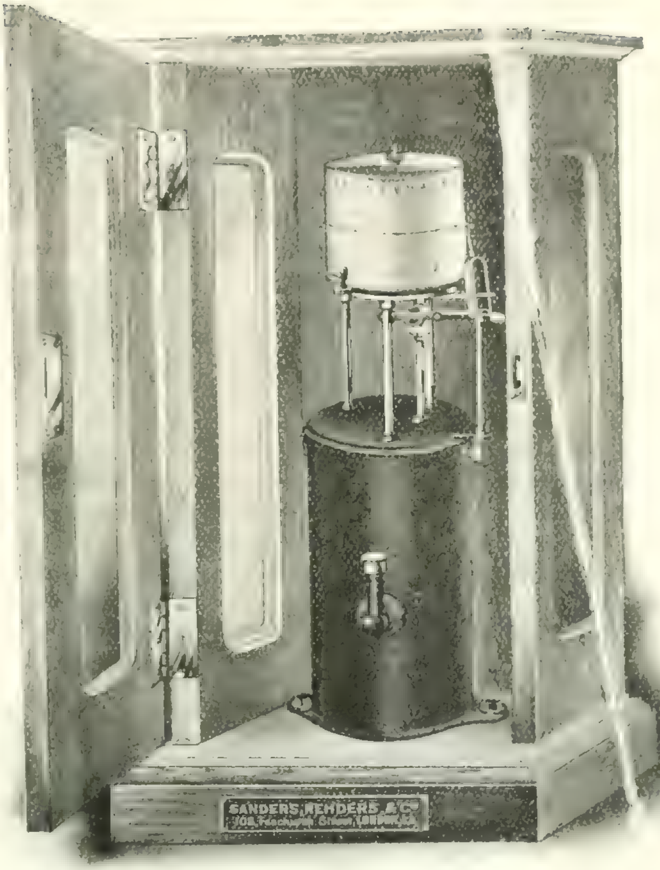


FIG. 2. DRAUGHT RECORDING INSTRUMENT.

The Configuration of Niagara.

In the course of an article in the Scientific American, Mr. Alton D. Adams states that Horseshoe Fall, Niagara, has receded more than 260 ft. within the memory of living man, and is now travelling toward Lake Erie at the rate of fully 500 ft. a centrry. At present the crest of the fall has a length of about 3,000 ft., but if the present rate of erosion continues the length of the crest may reach 8,000 ft. or more within the next half millenium.

One incident of this change will be its effect on the great power plants between Dufferin Islands and the present crest of the Fall, along the shore of Queen Victoria Park. Directly in front of and only 700 ft. to 1,000 ft. distant from these plants will then be the crest of the Fall, and a great reduction of the water level at their intakes must result. The present stockholders and bond-holders in these plants need not be alarmed, however, for long before the changes mentioned can be completed much of the equipment of these plants will have sunk in rust, after having earned, it is hoped, at least a fair return.

The Ohio Society of Mechanical, Electrical and Steam Engineers, holds its annual meeting in Canton on November the 17th and 18th, at which meeting there will be election of officers and some proposed changes of the constitution will be acted upon.

An ordinary view of the Zambesi Bridge at Victoria Falls does little to indicate the gigantic proportions of the structure and the vast area it spans. South Africa shows this in a novel way, by placing in a photo of the bridge, a view of the highest building in New York. It appears that the bridge could comfortably accommodate the huge skyscraper with 40 ft. to spare.

Junior Institution of Engineers.

On Saturday [illegible] last September [illegible] the members of this Institution paid a visit to the Staines Reservoirs Communication Works (including pumping plant and boilers) of the Metropolitan Water Board at Kempton Park. The visit was made by permission of the chief engineer, Mr. William B. Bryan, and under the guidance of Mr. Joseph Francis, engineer of the works, and Mr. C. W. Pettit (member), representing the contractors—Messrs. John Aird and Sons.

From the Staines Reservoir intake the water will flow into a suction tank (1,000,000 gallons capacity) from which it will be pumped to a height of 24 ft. into two subsiding reservoirs (300,000,000 gallons joint capacity). Thence it will flow through 42 in. pipes to the filter beds, twelve in number. Sand-washing apparatus is provided, and settling tanks and coke filters for treating the effluent sand-washing water before its delivery into the Thames. The filtered water will be pumped through a 42-in. main to Cricklewood (13½ miles), where it will be again pumped 3¾ miles to a service reservoir at Fortis Green, Finchley, at a level of 298 ft. above O.D. The engine-house at Kempton Park, which was open to the inspection of the members, contains two first-lift engines, three second-lift engines, and eight boilers. The members of the Institution were afterwards entertained by Messrs. John Aird and Sons.

Slate Quarrying at Llanberis.

An enormous body of rock which was impeding the [illegible] of the [illegible] slate quarries, Llanberis, was brought down on Saturday by means of explosives. The dyke, con- [illegible] render the removal as complete as possible ten shafts had been bored in the rock at two different levels as receptacles for the explosives. Five of these shafts were worked at the back of the rock from the outside, while the remaining five were situated beneath the rock at the end of a tunnel bored from the outside. Thus two independent sets of shafts were provided, and the firing of one set was separated from the other by an interval of several minutes. Each shaft was 30 ft. deep. Four tons of Nobel's explosive gelatine were used, and the firing was effected by means of a 15 minutes' [illegible]

An assembly of the Panama Canal Commission will take place on the Isthmus on October 1st, attended [illegible]

Sir Wm. H. Bailey on Methods.

Sir William H. Bailey contributes a suggestive article to the current number of Method entitled "Methods for Young Mechanics and Captains of Industry." The article, however, appears to be more concerned with maxims than with methods; its dominant note might be summed up in the phrase: Cultivate force of character. It includes a number of aphorisms from which we quote the following:—

"An educated engineer is like a storage battery; he must be ready for instant use."

"The time for the all-round man—the Jack-of-all-trades—having passed, one particular subject must be chosen, and that, in a perfectly sane manner, kept well to the front."

"Whatever may be the character of your studies, whatever may be your lot in life, learning without imagination is poverty."

"The time is now past when illiterate men, however able, can influence our commercial destinies."

"If young Englishmen ever had a chance, as we call it, they have it now, for the rewards of scientific and honest industry are greater than ever."

All these remarks are sufficiently inspiring. It is certainly time that someone defined the methods and maxims by which young engineers are to reach the goal of success. A man was recently advertised for to look after an electrical plant in the country and he was also to keep an eye on the cow and make himself generally useful about the estate. A contemporary also has been devoting columns to correspondence which seems expressly designed to show that the rewards which Sir William Bailey refers to are largely chimerical.

The long-discussed project of tunnelling the Col de la Faucille, and finally Mont Blanc, is at last (says a Paris correspondent) to be carried out. M. Gauthier, Minister of Public Works, has concluded the necessary financial arrangements with the Paris, Lyons, and Mediterranean Railway Company. The Swiss Government has also agreed to assume part of the cost.

The viaduct which Sir William Arrol and Co., Ltd., are to build to span the Walney Channel between Barrow-in-Furness and Vickerstown is to be of the Scherzer type. The opening span will be the largest yet constructed in this country. The width between the footway parapets will be 50 ft., and the total length of the bridge between the abutments will be 1,123 ft. There will be eight spans of the lattice girder type. The Scherzer rolling lift leaves will be in the centre, and will be actuated by electric power.

ELECTRICAL EXHIBITION AT OLYMPIA.

THE exhibition which will be opened by the Lord Mayor at Olympia on Monday next, promises to be quite the most notable of its kind that has yet been held in this country. The exhibits at the exhibition will cover all branches of the industry—lighting, traction, the driving of machinery, electro-metallurgy, and domestic applications. The development of electrical science during recent years and its growing applications to the needs of our great industries has put it into the front rank among applied sciences. Yet in spite of the marked developments which have taken place during the last ten years there are, as Colonel Crompton pointed out in the James Forrest lecture a few months ago, many problems in electrical engineering which await solution. In particular those arising out of the electrical operation of tramways require further investigation, while those connected with railway traction are among the most important.

The exhibition is being run under powerful auspices. It is under the patronage of the Institution of Electrical Engineers, and supported by the National Electrical Manufacturers' Association. The president is Sir William H. Preece, and he is backed by a strong executive committee of which Mr. E. Cunliffe-Owen, of the Metropolitan Electric Supply Company, is the chairman. At the moment of writing it looks as if things might be a little unready on the opening day, but those who are in a position to know are confident that Monday morning will see no signs of unpreparedness. Certainly magnificent efforts are being made to this end. Some three or four hundred men are now at work daily, excavating, building foundations, and making arrangements for a successful opening.

The Institution of Electrical Engineers is giving something more than mere patronage, inasmuch as it has made arrangements for a number of eminent members of the institution to deliver lectures with a view to educating the public in the development of the industry, more particularly in its application to commercial needs. The following is the list of lectures already arranged:—September 29th, "Wireless Telegraphy," by Mr. W. Duddell; October 3rd, "Development of the Use of Electric Motors," by Colonel R. E. Crompton (past president); October 6th, "Domestic Lighting," by Mr. J. Swinburne, (past president); October 10th, "Meters," by Mr. S. Z. de Ferranti; October 13th, "Telegraph" (ordinary), by Mr. A. Martin, October 17th, "Arc Lighting," by Mrs. Ayrton; and October 20th, "Telephones," by Mr. F. Gill.

A preliminary notice of exhibits appears below.

E. GREEN AND SON, LTD.

This firm are showing the Green economiser and heater installation in conjunction, which is illustrated in fig. 1. The latest design of air heater is specially

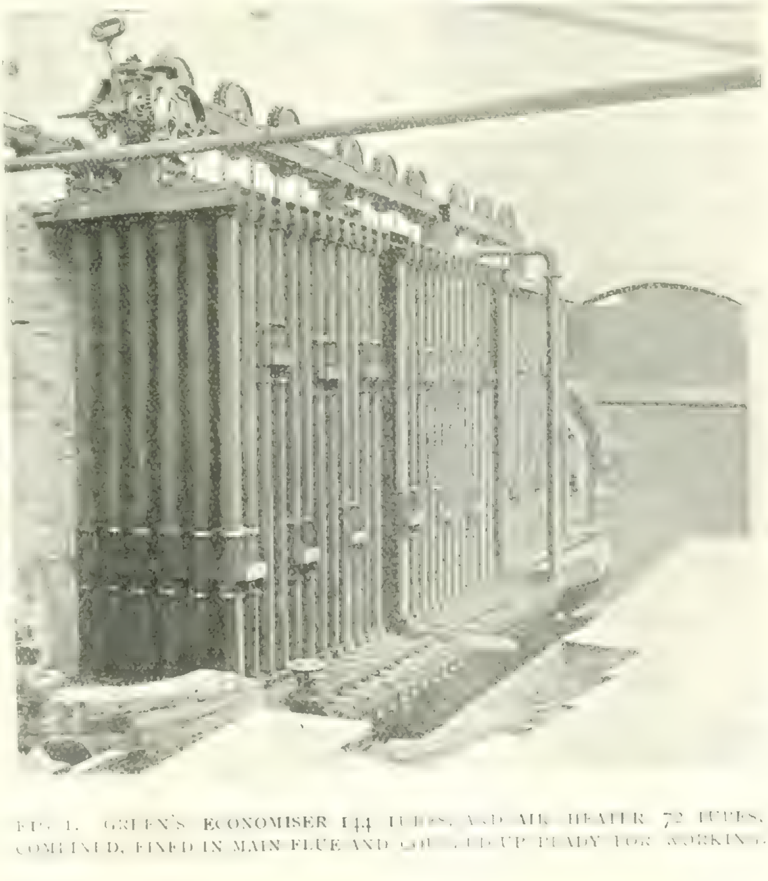


FIG. 1. GREEN'S ECONOMISER 144 TUBES, AND AIR HEATER 72 TUBES, COMBINED, FIXED IN MAIN FLUE AND [illegible] UP READY FOR WORKING.

constructed to supply a large volume of hot air for drying purposes. The heater is designed, with certain modifications, to work on the same principle as the economiser, the air passing through the tubes receiving heat from waste flue gases in like manner to the boiler feed water. It may be worked separately or in conjunction with the economiser. In this case the economiser is fixed nearest to the boilers and receives the first impact of the gases.

The heater consists of a series of cast-iron tubes 9 ft. long, with an internal diameter of 3⅞ in., which are hydraulically pressed into top and bottom boxes of a special sloping design, forming sections with perfect metal-to-metal joints. The sections are fixed in the main flue across the path of the gases, and are connected at the top and bottom by air ducts of large capacity. The cold air is forced into the apparatus by means of a fan through the air duct at the bottom or the top.

In the plant illustrated the economiser contains 144 tubes and the air heater 72 tubes.

The following are the average results obtained during a series of tests made with the combined plant on April 15th and 16th, 1904:—

Temperature of gases entering economiser, 460 deg. F., temperature of gases entering air heater, 301 deg. F., temperature of gases leaving air heater, 257 deg. F., temperature of water entering economiser 112 deg. F., temperature of water leaving economiser 248 deg. F., temperature of air entering air heater, 70 deg. F., temperature of air leaving air heater, 152 deg. F.

D. P. BATTERY CO., LTD.

Four types of the D. P. batteries are exhibited. The "Strip" storage battery, the "Lumford Light," the "Lumford Heavy," and the "Lumford" station type. In these batteries the peroxide plates are produced by a special electrolytic process, which causes the active material to be formed out of the plate itself. The "protecting coat" is thus extremely dense and the oxides in good condition for electrolytic action. This special construction gives a large working area, and is claimed to enable the cells to be charged or discharged at high rates with a minimum risk of disintegration or buckling. The spongy lead plates are constructed so as to key in the active material on both sides. The Lumford batteries are of the hanging type, with cast Planté positives of large surface with skin formation, the plates being suspended upon the sides of the glass boxes, and are designed to meet the demand for a cell of this type, combined with the simplicity of handling for erection of the Strip type. The [illegible] and the

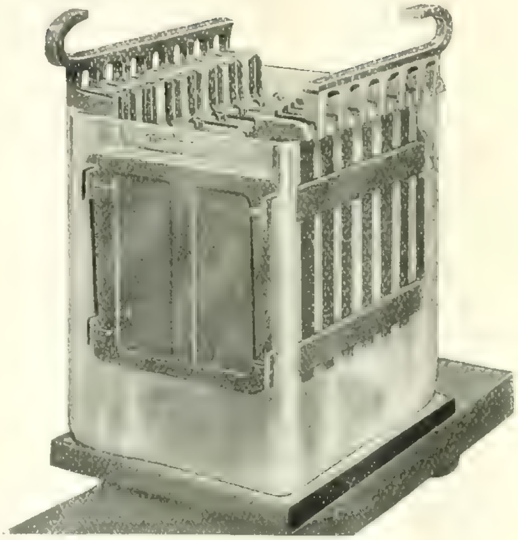


FIG. 2. LUMFORD LIGHT TYPE BATTERY.

Lumford types are suitable for central station work, or installations where high rates of charge and discharge may be necessary.

EVERETT, EDGCUMBE AND CO., LTD.

We illustrate in figs. 3 and 4 the leakage indicators for use in coal mines, designed by the company to comply with the 1905 Mining Regulations, and which have been officially accepted.

Fig. 3 shows the connection for direct-current two-wire systems with both poles inserted and for three-phase systems with all three mains insulated the connections are as shown in fig. 4.

The switch is left permanently on the stop marked "Normal" and the pointer should then stand at zero

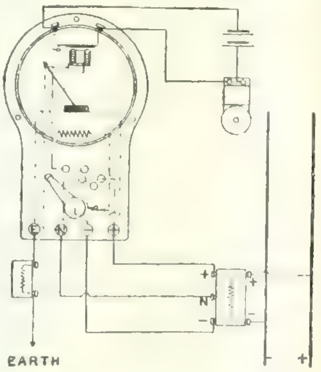


FIG. 3. SHOWING CONNECTION FOR DIRECT-CURRENT TWO-WIRE SYSTEM, LEAKAGE INDICATOR.

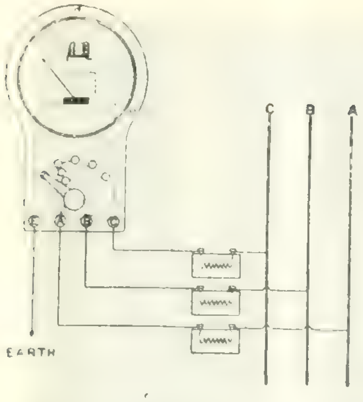


FIG. 4. SHOWING CONNECTION FOR THREE-PHASE SYSTEM.

So soon as a fault develops on either main, the fact is shown by a deflection of the pointer in the corresponding direction. A relay and electric bell are also provided, so that the presence of a fault is at once indicated and the attention of the attendant drawn to it.

Daily readings are to be taken and duly entered up, of the deflections obtained when the switch is connected to the stops marked " + test " and " — test." These readings give an indication of the relative leakage from the positive and negative mains respectively.

This firm is also showing a watt-photometer and street lighting photometer.

PEARSON FIRE ALARM, LTD.

The protection hitherto afforded by automatic fire alarm in business premises in which loose steam, acids or excessive moisture are present, has been liable to interruption. The Pearson Company, however, by the use of specially-designed instrument, illustrated in fig. 6, proposes to cope with this difficulty, and this form of enclosed thermostat is exhibited for the first time. It embodies the principle of expansion of metal and is built in the form of an oblong chamber approximately 5 in. by 2 in. by 1½ in. This box carries upon the underside fixed rigidly to it a thermal strip. In the centre of the strip is erected a metal pin having an insulated tip. This pin passes into the box, through a packed chamber, thereby guarding against an accumulation of moisture or acid, but leaving the blade free to move for the purpose of making contact. The internal apparatus consists of two contacts built upon an insulated base and connected to a terminal at each end. One contact is adjustable as to temperature; the other contact is built upon a flexible hard-drawn phosphor bronze spring, and rests upon the insulated pin of the thermal strip. Any deflection of this strip by means of heat at once affects the position of the flexible contact, and when the heat reaches the temperature at which the instrument is set, contact is made and the alarm is given. The connecting wires are led to the terminals through stuffing boxes, and to facilitate inspection, a cover is provided, which is seated upon a thermal packing held rigidly in place by metal screws. It is claimed that movement of the contacts can only be effected by the action of heat, and by reason of the terminal wires being enclosed, no imperfect insulation can occur owing to the presence of moisture, acids, etc Fig. 5 show a section of the latest type of Pearson thermostat.

When the metal strip *b*, which is firmly fixed at each end, expands, it makes contact with the pointer *c*, which is in connection with one terminal through brass plate *f*, but is isolated from base *a*, and the other terminal, which latter is in contact with metal strip *b* through the base *a*, so that as soon as the pointer *c* and the metal strip make contact the connection is made between the two terminals to which the wires are connected. These terminals are not shown in the section. It may be noted that the pointer *c* is attached to a Fahrenheit scale, and the thermostat is so constructed that the distance between the pointer *e* and the metal strip *b* is regulated by setting the needle of the pointer at the required temperature, and immediately that temperature is reached the alarm is automatically given. When fixed, the pointer and scale are protected by the metal cap *d* to prevent accidental alteration of the setting.

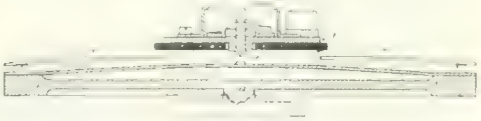


FIG. 5. SECTION OF THERMOSTAT, PEARSON FIRE ALARM COMPANY.

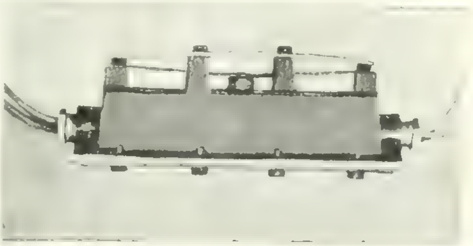
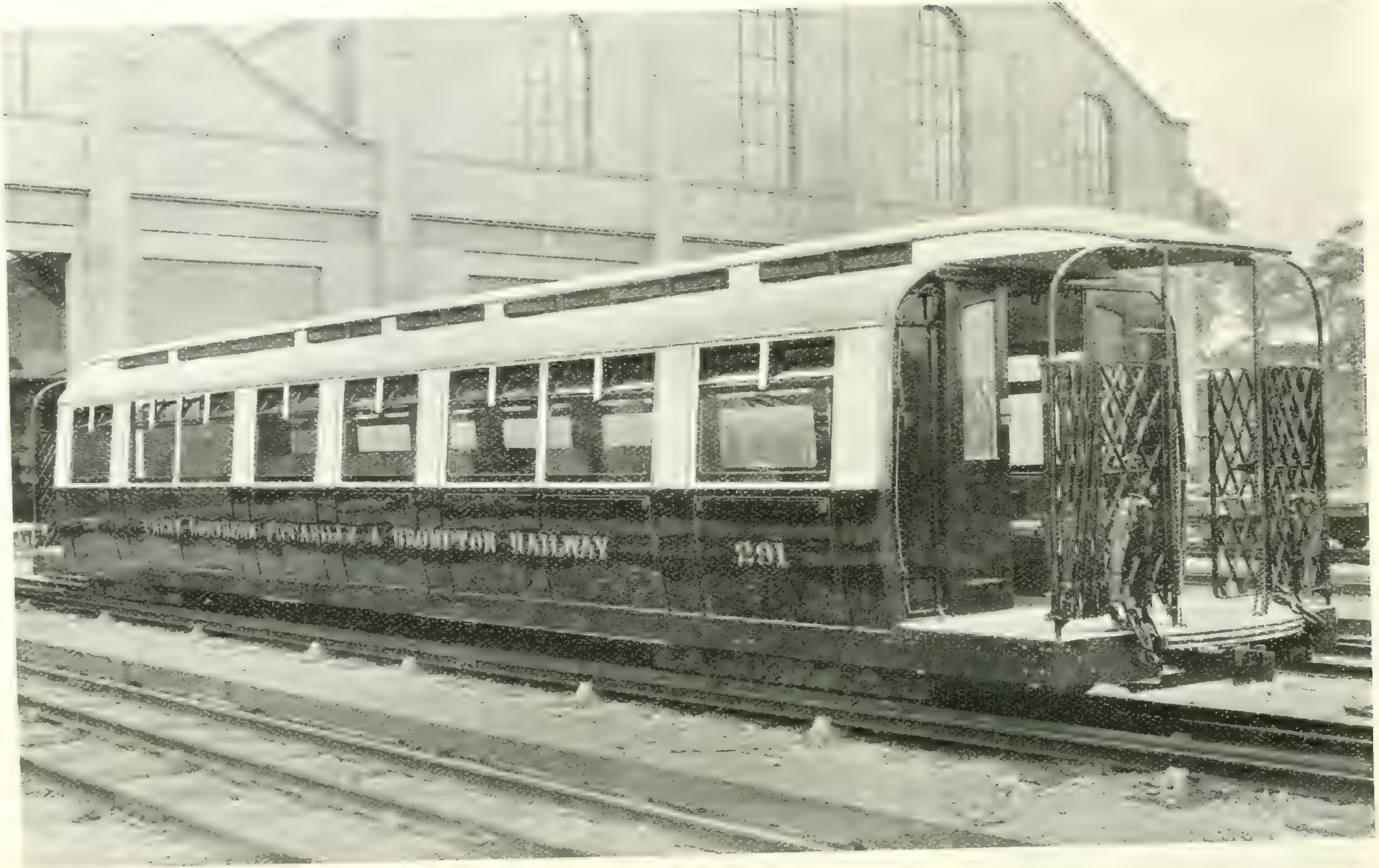


FIG. 6. NEW DESIGN FOR ENCLOSED THERMOSTAT

(*To be continued.*)



STEEL RAILWAY CAR BY THE BRUSH ELECTRICAL ENGINEERING COMPANY, LTD., FOR THE GREAT NORTHERN, PICCADILLY AND BROMPTON RAILWAY.

Length over platforms, 46 ft. 9½ in., height 9 ft. 5½ in., width 8 ft. 9 in. Weight, 15 tons 17 cwt., seating capacity, 54.

STEEL RAILWAY CARRIAGES.

WE illustrate on the opposite page, the first steel-frame railway carriage constructed in this country. Cars of this type have been in service for several years in the United States, and it is stated that on the New York Subway wooden stock is to be entirely superseded by these steel carriages. In this country the Central London Railway have experimented with American-built steel railway carriages, but it is only n w at the initiative of Mr. Yerkes that the Brush Engineering Company has turned its attention to the work. As will be noted from the illustration the car is intended for service on the Great Northern, Piccadilly and Brompton Railway, and it may be added that it has been built to the design of Mr. G. C. Cuningham, the general manager of the Central London Railway, who, having had experience of steel cars on that line, has been able to embody in his design several improvements which have been suggested by the experience gained. The accompanying table gives some interesting statistics with regard to the car.

Mr. Yerkes has, from the time he undertook the responsibilities in connection with the traffic problem in London, fully realised the necessity for ensuring absolute safety from fire on underground electric railways, and some thousands of pounds were spent by the Brush Company in erecting special plant for the chemical treatment of the timber to be used in constructing District Railway cars at the Loughborough Works. The company was, however, already experimenting with steel-car construction, and it became apparent that the future demand was more likely to be for steel than for fire-resisting timber.

The new railway carriage is claimed to be superior to the standard wooden car in three respects. The first is its absolute immunity from any danger of fire; the second, a considerable reduction in dead weight; and the third—consequential on the second—consists in the material reduction it will effect in expense of haulage.

In view of the shrinking margin between receipts and expenses on many railway lines, much interest is being manifested in the question whether the solution of this problem is to be found in the substitution of steel for wood as the principal material employed.

The cost of the steam or electricity required to propel each ton of rolling stock in regular service is a very important figure in railway economy. On the London Underground lines it is estimated at £25 per ton, and a saving of three tons in the weight of a coach is therefore worth £75 a year in net profit. As there are over a million passenger and goods vehicles on British railways, the aggregate saving to be effected if timber were superseded by steel would reach a very large sum. The steel carriage built by the Brush Electrical Engineering Company is formed of a steel frame with a body of pressed and riveted steel sheets. Its length over platforms is 49 ft. 9½ in., its height from rail to roof 9 ft. 5⅜ in., its interior has a perpendicular of 7 ft. 6 in., whilst its extreme width is 8 ft. 9 in. The seating capacity of the car is 54, and its total weight 15 tons 17 cwt., against the 21 tons 5 cwt. of the Metropolitan District Railway coaches, seating 52 passengers and the 18 tons 16 cwt. of the coaches of the Great Northern and City Railway seating 58 passengers. The interior sides of the steel coach are faced with non-inflammable wood panelling, but this is likely to be superseded in future deliveries by steel or aluminium sheeting. There is nothing in the appearance of the interior to differentiate it from the ordinary wooden carriage. The Brush Company is building eighteen steel cars for the Great Northern and City Railway Company.

DESCRIPTION	Great Northern and City R.	Metropolitan District R.	Great Northern Piccadilly and Brompton Ry. STEEL COACH
Length over body	[illegible]	[illegible]	[illegible]
Length over platforms	[illegible]	[illegible]	[illegible]
Width over platforms	9 4	[illegible]	8 8
[illegible]	[illegible]	[illegible]	[illegible]
Height [illegible]	[illegible]	[illegible]	[illegible]
Height from rail to roof	[illegible]	[illegible]	[illegible]
Wheel Base	[illegible]	[illegible]	[illegible]
Bogie Centres	[illegible]	[illegible]	[illegible]
Diameter of Wheel	[illegible]	[illegible]	[illegible]
Seating Capacity	[illegible]	[illegible]	[illegible]
Weight	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	918 lbs	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

A NEW WORK ON ELECTRIC TRACTION.

By Professor Robert H. Smith, A.M.Inst.C.E.

THE supreme difficulty encountered by a writer on the subject of electric traction is that before his work is through the press the subject-matter may be in some respects out of date. Electric traction has made very extraordinary demands upon engineering skill during the past decade and for the credit of the profession, it must be said that those demands have been and are being loyally met.

Professor Smith has overcome the difficulty referred to by seeking the co-operation of those who are foremost in this field. He has been able to get together a remarkable record, and to reflect with considerable skill, the present position of this sphere of electrical activity, more particularly as regards the trams and tubes of London. The author, it is true, goes further afield dealing in detail with some very well-known provincial tramways and schemes of electrification, and from thence proceeding to Germany, Italy and Switzerland, but we fancy the average reader will find most interesting the sections devoted to metropolitan areas, including as they do so many works in actual progress. A point to be noted is the amount of attention given by the author to economic results and commercial conditions. This we owe to his conviction that no technical science will ever be rationally complete until it rests equally upon the two bases of physical and economic law which together govern all industry.

In his preliminary survey, the author refers to the large field which awaits the successful evolution of the secondary battery when the questions of weight and the mechanical disintegration of the plates have been finally disposed of. An enormous number of mechanically-driven shop delivery vans, parcels vans, and post-office vans will be used as soon as an entirely satisfactory and reasonably cheap design is procurable. He opines, however, that electric traction is never likely to have any chance in the competition for the heavy wagon and lorry traffic.

As regards the spread of electric tramways, we are reminded that we have been first in the field of invention as usual, and last in the field of development. The sting conveyed in this reflection is removed when we arrive at the middle of the volume where it is pointed out that as a result of these delays London is at any rate getting her installations designed in the light of a vast amount of experience which has had to be paid for in other parts of the world. Moreover, electric traction is now being pushed forward to such purpose that according to the author there will very shortly be some 5,500 miles of electric track in operation in the United Kingdom. We have over £80,000,000 capital at the present time expended or subscribed in tramway enterprises, and the author is at great pains to tell us how it is being spent.

The amount of power used, he remarks, is of great technical interest; but it is of minor commercial importance, its cost being almost swamped by the magnitude of the other expenses not amenable to scientific engineering minimisation. The following table shows approximately how the cost of running one car over one mile is made up:—

TOTAL COST PER CAR MILE.

Working costs, 5½d.	
Power	
Traffic expenses	3d.
General expenses	1d.
Plant repairs and maintenance ..	1d.
Capital charges, 4½d.	
Roadway maintenance and renewal ..	¾d.
Depreciation at 5 per cent.	2¼d.
Interest at 3 per cent.	1½d.
Total	10d.

The author states that although many minor installations may do worse than this, the above is a conservative view of the capabilities of British electric tramways, and it may be confidently reckoned that skilful and energetic management will always be able to show somewhat better results. Under more fortunate conditions considerably better results can and are actually obtained.

Electric Traction. By Robert H. Smith, A.M.Inst.C.E. With [illegible] Brothers [illegible]

In the earlier part of the work we hear a good deal about our old friend the Glasgow tramway system, and an informing chapter is devoted to the structure and working of overhead trams.

Conduit tramways naturally come next into view, and here the author gives, inter alia, an account of the length of conduit system recently completed at a cost of £13,000 per mile between Kennington and Streatham. Of the new Greenwich Central station he remarks that it is the intention to lay down 48 water-tube boilers, working at 200 lb. to the square inch pressure. These are to supply eight surface condensing engines, each of a normal horse-power of 6,500, at 94 revolutions per minute; or 52,000 h.p. in all. There are to be eight three-phase dynamos, each generating 3,750 kilowatt, or 5,000 h.p., at a frequency of 25 per second, and 6,600 volts in each phase-difference; the total electric capacity being thus 40,000 h.p., or 77 per cent. of the engine indicated horse-power. There will be one exciter to each dynamo, and the intention is that it shall be rope-driven. All auxiliary plant is to be motor-driven. Oil switches will be used for all high-tension control, and these will be operated electrically from a distance by low-tension relay apparatus.

This station is situate on the south bank of the Thames, and coal will be supplied to it by water, condensing water being also taken from the river. It is intended to supply energy to tramways north as well as south of the Thames. It is being laid out under the superintendence and direction of Mr. J. Rider. Another generating station is projected, and a site for it has been purchased at the price of £80,000 in the Pimlico district, also close to the river, with wharfage; but this is not likely to be required for the next few years.

Incidentally, attention is devoted to the shallow subway conduit tram line which is being completed by the London County Council under the new Holborn to Strand thoroughfare known as Kingsway, being the first tramway link between the Thames and the northern part of the city. It is hoped, says the author, soon to break down the persistent opposition that has hitherto defeated the proposals to bring the tramways across the bridges and along the Embankment. When this first line from the north and debouching on the Embankment is finished and its utility has been demonstrated, it will be found impossible any longer to obstruct the completion of the network between north and south. From the point of view of tramway development in London, this is the most important aspect of the Kingsway undertaking.

Elsewhere the author remarks that the Kingsway subway is an instructive case of intermediate character. "Although at the moment of writing this, it has not yet been finally determined whether conduit and plough collection of the current will be used, still it is safe to predict that this will be the case provided that the same system be used throughout London north of the Thames. It would be extravagantly uneconomical to provide all the cars running from the northern districts to the Kingsway with apparatus for two different methods of current collection; while it would also be considered in London as intolerably inconvenient to the passengers to compel them to change cars for the purpose of running through this half mile of subway. Therefore, the same system will be, or ought to be, adopted in the subway as throughout these northern districts. But, except for the sake of such uniformity of system, the conduit is an entirely wrong construction for the subway, as its extra costliness carries with it no advantages of any kind in this situation. An overhead wire, or a third-rail conductor, is clearly the best and most economic plan upon all railway-tunnel systems."

Surface-contact tramways and some of the problems connected therewith having been discussed, the author weaves together a mass of information on the subject of London deep-level electric railways. Speaking of the Central London system he remarks that the records of current consumption do not show that the change from the gearless locomotive to the motor-car driving has resulted in any greater mechanical efficiency. With the gearless locomotives the consumpton was from 42 to 48 watt-hours per ton-mile. With the geared locomotives it seemed to vary from 40 to 58. Measurements on the motor-car trains gave from 41 to 48. It is to be noted, however, that the latter tests were taken with trains some 40 per cent. lighter than in the other tests, and that with heavier load the motor-car consumption per ton-mile is probably materially less than the above. The motor-car arrangement, however, gives rather more seating accommodation per ton of train. It gives 2·85 seats per ton, whereas with gearless locomotives it was 2·44, and with geared locomotives 2·57 per ton.

As to the methods of driving these deep-level tunnels, the author points out that nearly the whole of the Central London tunnels were excavated by hand labour, the cutting-edge of the shield doing no more than trimming the cutting to proper shape and size. But already, when the western half of this work was only partly completed, attempts were made by the contractor Mr. John Price, and his engineer, Mr A. W. Manton, to use a boring-machine which would cut the whole section without any hand picking. The machine first used was mounted on a large driving shaft lying in the central axis of the tunnel, with a front bearing in the shield and a rear bearing upon a girder platform bolted to the rings ot the completed part of the tunnel, which platform carried the driving engine operated by compressed air. The obstruction caused by this central shaft, engine, and gearing, and the difficulty arising in the adjustment of the bearings when the shield was rounding curves, caused trouble with this machine, although it did a great deal of useful work, and demonstrated that the machine cutting-action was entirely satisfactory. In the tunnels now being excavated the bulk of the work has been done by an improved machine electrically driven.

In his chapter on London Surface and Shallow Electric Railways, the author says that considered from the non-technical and non-expert points of view, the decision to adopt low-tension electricity for the electrification of the Metropolitan and District Railways was no doubt well justified, because of the very large financial and public interests at stake. Nevertheless, well-informed and experienced electrical engineers regretted the decision, and there is little doubt that ten or twelve years hence, when the present continual extension of high-tension systems have familiarised the English public with their economic merits and their comparative safety, the London Surface and Shallow Railways now near completion will be thought as old-fashioned as their filthy smoke-and-sulphur-choked Underground has been regarded for fifteen years past. Thus does London insist on marching always in the rear rank and living on the standard of comfort appropriate to a past generation.

In passing, the author notes how all large modern traction installations are steadily gravitating towards insulated returns. For fifteen years the writer has advocated this policy, and has pointed out that it will gradually become a practical necessity as the amount of electrical power transmitted per acre of land surface becomes very large.

After giving a complete account of the electrification of the Underground Railway, the author proceeds to provincial electric railways, and at the conclusion of the chapter on Surface and Shallow Electric Railways, lays stress upon the fact which we trust will never be forgotten in this country, viz., that all electric tramway and railway material can now be supplied from English and Scotch workshops, of the highest quality, both in design and workmanship. This may be said to close the English section, for the remaining chapters deal with the Berlin electric railways; Italian direct-current railways; Elberfield mono-rail; high-tension alternating-current railways in Italy; and Swiss three-phase railways and Zossen high-speed trials. The work is fully illustrated and is a creditable and painstaking production.

THE DESIGN OF RAILWAY CARRIAGE WHEELS.

Mr. James Keith, A.M.Inst.C.E., M.Inst.Mech.E., writes a letter to the Manchester Guardian in the course of which he asks: Are the wheels of railway carriages properly designed and constructed for the excessive speeds of the expresses of to-day? What was designed for, and what was good enough for, an average speed of thirty or forty miles an hour is, he fears, scarcely suitable for the excessive high speeds of the present through mail trains, and the only reason perhaps why more such seemingly "unexplained" disasters do not occur may lie in the fact that as a rule the locomotives and coaches of such trains have been almost as proportionately increased in weight as they have been in speed running. The construction of the wheels, however, with their somewhat unreliable guide or guard flanges, remain practically the same as it was fifty years ago.

Remarking that there is in general and present use practically only the projection of an inch, more or less, on the inside of each wheel to jump on all our trains, and standing, as it were, between life and death, he asks whether it is not time to inquire why more effectual means are not taken to prevent any possibility of the derailing of fast trains, where the risk is so great and where the security can at least be made so mechanically certain?

Why, asks Mr. Keith, in conclusion, should not the Board of Trade carefully examine into this question, so vital to the travelling public, and, if necessary, decree that the guard flanges of all the wheels of at least the fastest trains should be considerably deeper and proportionately stronger than they are at present. This being carried out and everything else being right there should certainly never be any more such lamentable accidents to record "cause unknown," as that at Witham.

THE USE OF GAS FOR POWER AND HEATING.

By Ernest A. Dowson, A.M.I.Mech.E.

(*Continued from page 589.*)

In order to illustrate the economy effected by the use of semi-water gas plants, it will be useful to set out the comparative running costs for power installations of 25 and 100 b.h.p. respectively, working on several well-known systems.

ANNUAL COST OF RUNNING POWER PLANTS.

	25 B.H.P.			100 B.H.P.		
	£	s.	d.	£	s.	d.
(A) **Electric Motor,** taking current at 1d. per Board of Trade Unit						
Current, allowing ¾ unit to develop each B.H.P.	205	0	0	820	0	0
Interest, depreciation, etc., at 7½%	4	10	0	11	5	0
Total	£209	10	0	£831	5	0
(B) **High-speed Steam Engine** with Lancashire Boiler						
Coal: 5 lbs. and 4 lbs. per B.H.P. per hour, respectively, at 12/- per ton	90	8	0	289	5	0
Water: 4 gallons per B.H.P. per hour at 9d. per 1,000 gallons	10	2	0	40	0	0
Labour, at 15/- and 27/- per week, respectively	37	10	0	67	10	0
Interest, depreciation, etc., at 10%	35	0	0	100	0	0
Total	£173	0	0	£496	15	0
(C) **Gas Engine on Coal Gas** at 2/- per 1,000 cub. ft.						
Gas, at 17 c.f. and 15 c.f. per B.H.P. respectively .	114	15	0	405	0	0
Labour, 1 hour per day at 6d.	7	10	0	7	10	0
Interest, depreciation, etc., at 10%	16	0	0	50	0	0
Total	£138	5	0	£462	10	0
(D) **Gas Engine on Semi-water Gas.**						
Coal: 1 lb. per B.H.P. per hour at 20/- per ton ...	30	0	0	120	0	0
Water: ¾ gall. per B.H.P. per hour at 9d. per 1,000 galls	2	0	0	8	0	0
Labour, at one-third of case B.	12	10	0	22	10	0
Interest, depreciation, etc., at 10%	25	0	0	65	0	0
Total	£69	10	0	£215	10	0

From this table of working costs it is clear that the combination of gas engine and plant, taken in case D, forms by far the most economical installation to use. In fact, the difference is so great that, even where power is only called for during, say, three consecutive hours each day, it will generally be worth while to adopt the system. With the exception of wind and water power, which are seldom available, there is no other way of realising similar results.

MARITIME GAS ENGINES.

It is of interest to note that the gas engine is now being adapted to the running of motor vessels. The first installation recorded was that of a canal barge, which was fitted with gas engines and plant of the "suction" type by Herr E. Capitaine, of Frankfort. Gas engines are, however, somewhat heavy in proportion to the power developed: this and other points militate against their use for the purpose on more than a moderate scale. Attention is consequently being directed to possible modifications. The engine designed by Herr Capitaine embodies the principle of the "free-flight" piston somewhat as in the old "Otto and Langen" engine, although the method of working is different. Messrs. John I. Thornycroft and Co. are also working in this field. Great developments are sure to follow in this direction.

The above general remarks also apply to the driving of motor cars on the same system. There are a good many knotty points to be overcome before fast passenger vehicles can be dealt with, but the heavier class of lorries for transporting goods provide a field in which we may expect some progress.

Reviewing the practical working of gas engines, we note that Dr. Otto's method of compressing the explosive mixture is in general use, although the cycles of some of the engines, especially the larger ones, have been modified in recent years in accordance with the ideas of Clerk and other designers.

While all present day engines operate on one or other of these two distinct cycles, the "four stroke" or the "two stroke," there are, nevertheless, quite a number of special arrangements of pistons and cylinders which are adopted by various British and especially Continental makers of large engines.

A notable installation is a group of seven blowing engines running at the Cargo Fleet Ironworks, Middlesbrough. These are on the lines developed by the Cockerill Co., and were built by Messrs. Richardsons, Westgarth and Co., Ltd. They have only one power cylinder, 51½ in. diameter by 55 in. stroke, and at a speed of 80 revolutions per minute, will each indicate 800 h.p., so that this installation is a large one.

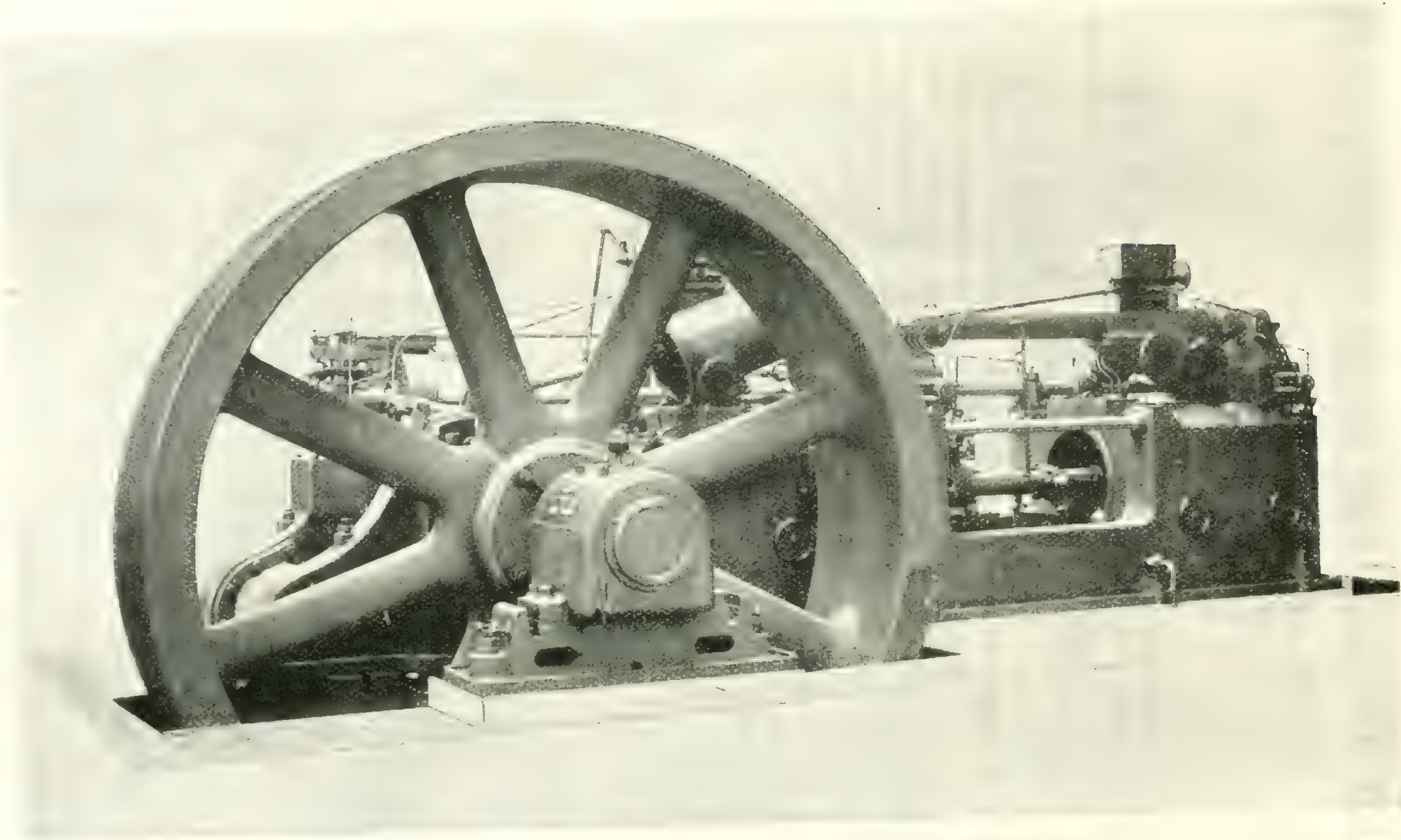


FIG. 1. PREMIER TANDEM-CYLINDER ENGINE OF 650 H.P. FOR DOWSON GAS.

This engine is one of seven running in works at Wolverhampton. All the engines are fitted with the Premier special arrangement for positively scavenging out the exhaust gases on the fourth stroke of the cycle.

TYPES OF ENGINES.

Fig. 1 shows a tandem cylinder engine of [illegible] h.p. by the Premier Gas Engine Company. This engine is one of seven of various sizes, running in a Wolverhampton works, using Dowson gas, the batch aggregating 1,800 h.p. A further portion of this installation is illustrated in fig. 3, and comprises three single-cylinder engines of 250 h.p. each. All the engines are fitted with the Premier Company's special arrangements for positively scavenging out the exhaust gases on the fourth stroke of the cycle.

An extensive installation of Westinghouse engines is to be seen at the Central Electricity Station, Walthamstow, Essex. At this station there are some ten engines in all, aggregating 3,600 b.h.p.; they all run on Dowson gas, and are direct coupled to dynamos supplying current for working the tramways and lighting the district.

Fig. 2 shows a two-cylinder vertical engine of 550 b.h.p. by the British Westinghouse Company, being a sectional view.

Continental makers of large gas engines have gone in for great elaborations in the way of water cooling in order to get rid of temperature difficulties. With great ingenuity they have arranged to water-cool the pistons and piston rods in the double-acting engines, in addition to the ordinary cylinder jacket. The exhaust valves and their casings are also ingeniously water jacketted in most of these engines. It need hardly be pointed out, however, that the many complicated devices thus needed, introduce additional risks of failure, and it is reasonable to look upon them as a merely temporary endeavour to make a working engine of large power. In view of these facts it really appears to practical engineers that the best way of building such an engine is to replace the large single cylinder by several of moderate size, say three or four, each of which we know from experience is capable of being worked over long periods without any chance of breakdown. In support of this view it may be noticed that there is a decided feeling amongst many of the most important gas engine makers in the country in favour of the adoption of such an arrangement for large powers.

Before leaving the matter of high temperature difficulties in large engines, just touched upon, it is impossible to omit speaking of the advances which have been made during the last twelve months at the instance of Mr. Dugald Clerk. Mr. Clerk's principle has been adapted, in the first instance, to an engine

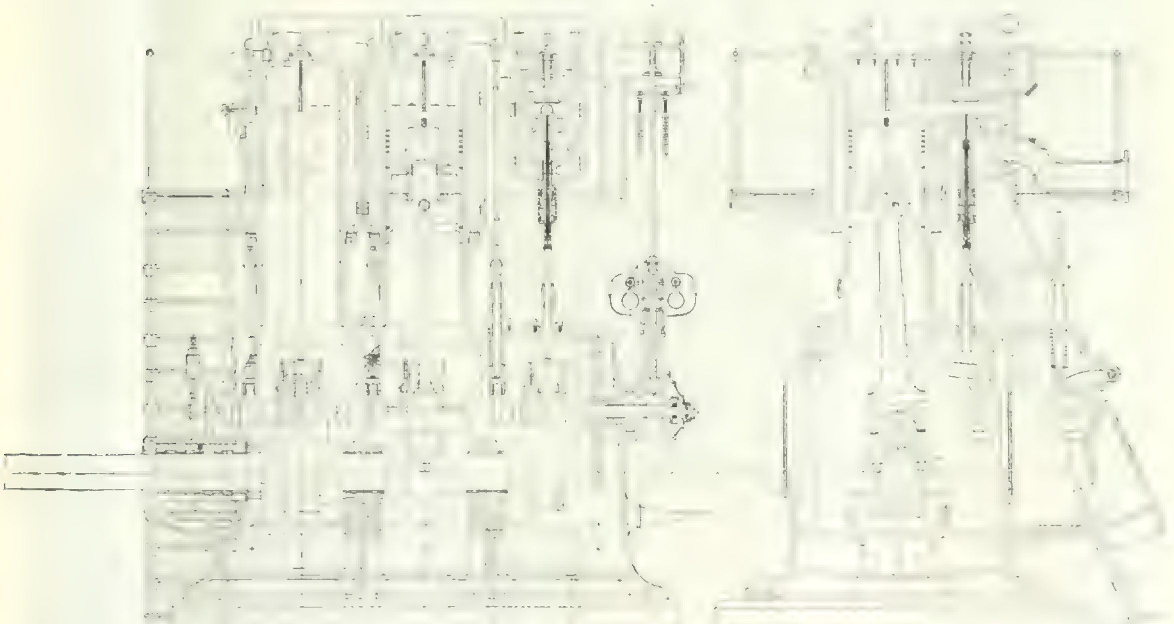


FIG. 2. SECTIONS OF SINGLE-ACTING WESTINGHOUSE ENGINE.

working on the four-stroke cycle. After the suction stroke of the engine has been completed and the whole of the explosive charge drawn in, the ordinary admission valve is closed, and through a secondary inlet an inert diluent is introduced in such a way as to stratify with the charge, and not to mix with it to any serious extent. The diluent may be either air or cooled exhaust gases. Compression afterwards takes place, and the charge is ignited in the usual way. The presence of the diluent serves to average down the flame temperature to an extraordinary degree, and a cool working engine is obtained without any other cooling than that of the ordinary cylinder jacket. Furthermore, the power developed in a cylinder of given size is increased, with a correspondingly higher thermal efficiency. The practicability of these ideas has been fairly well demonstrated.

An alternative scheme is that arranged by M. Banki, a continental engineer. On this system a few drops of water are sprayed into the cylinder during the suction stroke. This keeps down the temperature, so that, even with coal gas, a compression of 200 lb. per square inch may be used without fear of pre-ignition; a higher thermal efficiency may therefore be obtained.

IMPROVED IGNITION.

One important feature which has greatly contributed to the successful working of large engines is the improved form of ignition arrangement. A very favourite method is the use of a low-tension current, generated by a magneto machine of the Simms-Bosch pattern.

The normal system of governing hitherto in vogue has been the well-known "hit and miss," which is still the favourite one for engines of small and medium sizes, but latterly alternative methods have been re-introduced.

Great advances have been made by engine builders

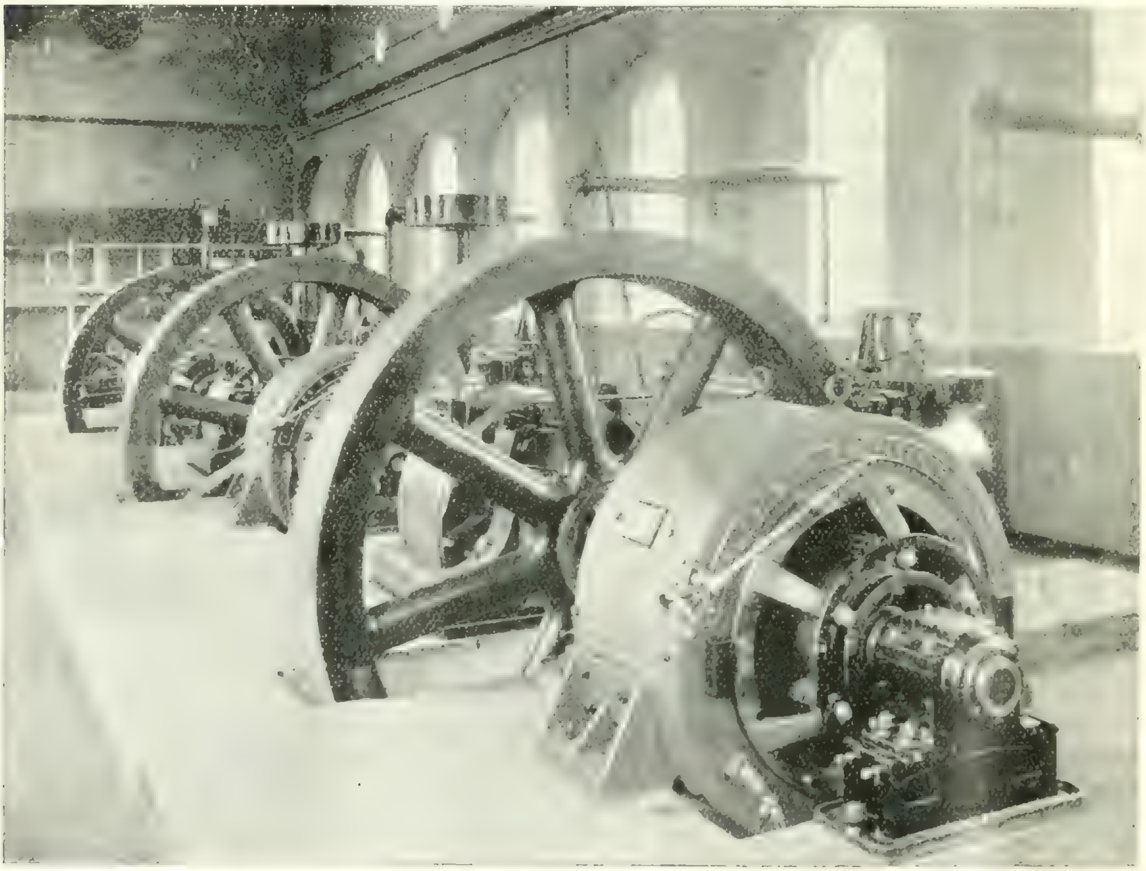


FIG. 3.—GROUP OF 250 H.P. PREMIER ENGINES.

in the general mechanical details and strength of the chief working parts, and it is now recognised that the failure of some of the earlier large engines was mainly due to want of strength and stiffness in such parts. These troubles are, of course, easily remediable.

In another direction also, makers have given much attention to the design of steady running engines, suitable for driving electrical generators in parallel, and the leading firms are now able to offer engines which can run with sufficient steadiness to drive alternators in this manner. It is not uncommon to find cases where the variation in speed between full load and no load is as small as from 2 per cent. to 5 per cent.

DIVERSITIES OF HEATING WORK

With reference to the many diversities of heating work, it is a little difficult to know what to select for mention, as the field for the application of gaseous fuel to heating is even wider than that of motive power. One may say, however, in the first place, that almost all heating processes now carried out with solid fuel may be better done with gas.

As has already been insisted upon in connection with power plants, it is necessary to exercise a good deal of judgment in each case as it occurs, and this is even almost a stronger necessity where heating is required. In the first place, it is necessary to decide whether or not the installation of a gas plant is justified by all the circumstances. Obviously, if any given appliance, at present coal-fired, shows a very high thermal efficiency, one has hardly a *prima facie* case for recommending the change.

It may be said without hesitation, however, that very large savings may be effected in this direction by most manufacturers. Apart from any direct saving, however, the adoption of gas firing enables us to have a much better control of the temperatures in our furnaces, while the more perfect combination which is effected is most important.

Temperatures of over 2,000 deg. F. can be obtained in a crucible furnace with Dowson gas without using any air blast, and taking the gas quite cold from the main. Much higher temperatures than this can be obtained by using an air blast.

For the larger industrial applications it is usual to construct the furnaces on the regenerative system, although these may generally be of the "continuous" order, without recourse to the principle of reversing currents usual in the Siemens furnaces. The gas itself is taken hot, direct from the generators, without passing through any system of scrubbers. For this class of work it is usually best to employ bituminous coal for the gas making, one reason being that we thus get the benefit of radiated heat from the luminous flame obtained. If possible, it is also well to utilise the sensible heat of the gas itself, and to this end the gas generator should be placed fairly close to the furnace to be heated. For the above and other reasons it follows that semi-water gas supplied from a distant central station is, in the author's opinion, anything but a good fuel for large furnaces. Of necessity it would be supplied quite cold, and as the hydrocarbons have been almost entirely eliminated the flame affords little radiant heat. For the generality of work this system is neither economical nor efficient, and cannot compare with the use of self-contained installations.

Abstract of paper read before Birmingham Association of Mechanical Engineers.

OBITUARY.

The death is announced of George C. Rumbold, who superintended the building of the *Great Eastern*.

The news of the death of Dr. Oscar May, at Frankfort, has been received with keen regret. Dr. May was one of the founders of the Elektrotechnische Lehr-und Untersuchungs-Anstalt of Frankfort. Of late years he has been consulting electrician to the Union of German Fire Insurance Companies, and he was on the "Safety Regulations" Committee of the Verband Deutscher Elektrotechniker. In his capacity as consulting engineer he took a large share in the conversion of horse tramways to electric traction.

Although he played a considerable part in public affairs generally, Sir Wyndham Portal will be best remembered for his long connection with the London and South Western Railway, of which he became a director in 1861 and finally chairman in 1892. He was thus intimately associated with the destinies of the line for over forty years, a period which saw great developments in connection with this railway. During his chairmanship the important scheme under which the London and South-Western Railway Company acquired the Southampton docks was carried through; and, although the chief credit for the initiation of that scheme was undoubtedly due to Sir Charles Scotter, then general manager, the chairman himself fully realised the important benefits which would result to the company from carrying it through, and readily took a leading part in the negotiations that resulted in the acquisition of the property. He retired from the board of directors in 1902.

OUR WEEKLY BIOGRAPHY.

PROFESSOR HUDSON BEARE, B.Sc., F.R.S.E., M.Inst.C.E., M.I.Mech.E.,

Regius Professor of Engineering, Edinburgh University.

PROF. HUDSON BEARE, F.R.S.E., M.INST.C.E.

PROFESSOR HUDSON BEARE was born at Adelaide, South Australia, on June 30th, 1859, and was educated at Prince Alfred College and the Melbourne University. He afterwards entered the chief engineer's office of the Public Works Department, where he was employed for three years, and at the same time attended evening lectures at the University of Adelaide. Here he eventually graduated B.A., and was awarded the South Australian scholarship, valued at £200 per annum, for four years.

Under the terms of this scholarship he came to this country and became a student for three years in the engineering department of the London University College. He was awarded a Gilchrist engineering scholarship, and obtained the B.Sc. degree. During his course at the University the second long vacation was spent in an engineering shop in the Midlands, and in the third year he became a pupil in the drawing office of Mr. Max am Ende, M.Inst.C.E., where he was engaged in the design of railway bridges, and of iron and steel roofs.

Upon the completion of his studies he entered the works of the Ashbury Railway Carriage and Wagon Company, Manchester. In 1884, while engaged with this firm, he was offered a post by Professor Kennedy, and became an assistant to him in his private professional practice, and a demonstrator in the engineering laboratory, University College, London. He remained with Professor Kennedy until 1887, when he was appointed the first professor of applied mechanics and engineering at the Heriot Watt College, Edinburgh, which post he held for two years. Here he was responsible for designing and superintending the building and equipment of the engineering laboratories and workshops, the first buildings of this nature on a large scale put up in Scotland. He organised the evening classes in applied mechanics, steam, and mechanical drawing for apprentices in engineering works, and in addition he arranged and was responsible for the lectures, drawing office, and laboratory work of engineering day students.

On the resignation of Professor Kennedy he was elected professor of engineering at University College, London. Professor Beare retained this appointment until June, 1901, when, on the recommendation of the Secretary of State for Scotland, Lord Balfour of Burleigh, he was appointed His Majesty Regius Professor of Engineering at Edinburgh University.

At the London University College, in conjunction with his colleagues, Professor Fleming and Professor Roger Smith, he was responsible for the planning and equipment of the new wing which was built in 1895 for the engineering department.

Since his appointment to Edinburgh in 1901, the number of engineering students has steadily increased, and the University Court having obtained the necessary money, a new block of buildings for the engineering department is being prepared for occupation at the commencement of the next session in October, and a new physics department is to be proceeded with immediately.

During the whole period since his appointment to the Heriot Watt College, in 1887, he has been actively engaged in professional practice as a consulting engineer, and in connection with this has carried out for various clients a considerable amount of research work. In particular it may be mentioned that he undertook a lengthy piece of original work for the Broughton Copper Company, Manchester, on the strength of copper and various other alloys at the temperature of high pressure steam, and on the strength of exceptionally long brass locomotive boiler tubes. This work involved the design of several pieces of apparatus of a special character, including a small testing machine for determining the compressive strength of full-size locomotive boiler tubes.

Professor Hudson Beare is a member of the committee on steam jackets, appointed by the Institution of Mechanical Engineers, and is now engaged on some important researches in connection with this committee's work. He was one of the staff of observers who carried out the marine engine trials at sea, organised by the committee on marine engine trials of the aforementioned Institution. In connection with the work of the above committees he has contributed a number of valuable papers to the Institution proceedings.

Professor Hudson Beare was a member of the committee on standards of thermal efficiency for steam engines, appointed by the Institution of Civil Engineers; the report of this committee was, as our readers are aware, adopted by the council, and published in the Proceedings of the Institution. He is also a member of the committee appointed by the Civil Engineers to determine the best methods of tabulating the results of steam and boiler trials.

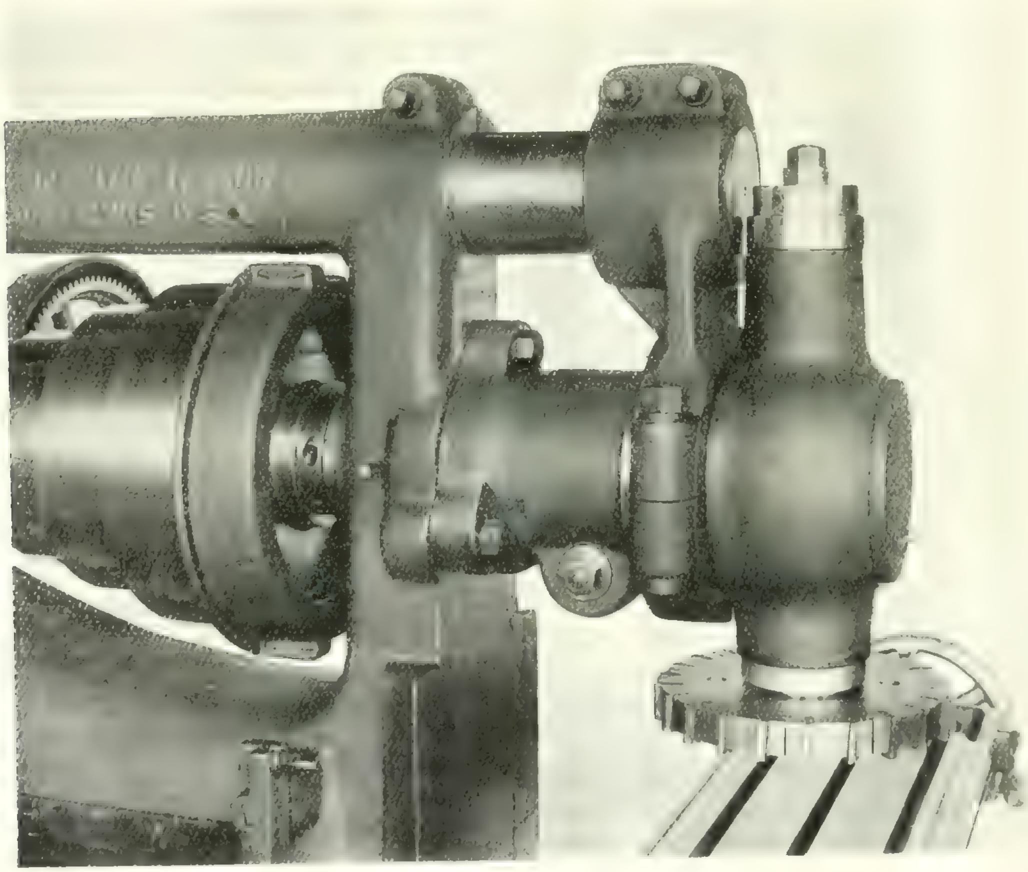
In January, 1903, Professor Beare delivered a special lecture to the graduates of the Institution of Mechanical Engineers on "Recent Developments in the Gas Engine." A frequent contributor to various technical journals, Professor Beare is the author of many articles on engineering matters in "Chambers' Encyclopœdia," and a large number of the lives of engineers for the "Dictionary of National Biography."

Professor Hudson Beare was recorder for the mechanical science section of the British Association for the years 1894–1900, and is a member of the research committee, appointed by this section to investigate the resistance to traction on common roads. He undertook for the Clarendon Press the English translation of the late Professor Cremona's works on "Graphical Calculus" and "Graphical Statics," published in 1888, and is now engaged in writing an advanced text-book on the strength of materials.

A NEW VERTICAL MILLING ATTACHMENT.

THE accompanying illustration shows an interesting vertical milling attachment of extra heavy and powerful pattern, just brought out by the Kempsmith Manufacturing Company, of Milwaukee, Wis., U.S.A. It is designed primarily for massive strength and rigidity sufficient to handle without undue strain the very heaviest classes of vertical milling which the power of the main spindle itself will stand, thus in effect converting a powerful horizontal miller into an equally powerful vertical miller. With this end in view, the attachment, as will be noticed from the illustration, is constructed on compact and simple lines.

The bevel gears in the head are large face and coarse pitch, of steel, and case-hardened. The vertical spindle runs in unusually long bearings, in order to maintain a perfect alignment, and its wearing qualities are claimed to be greater than any other similar attachment. Provision is given for delicate adjustment for wear. The head can be swivelled to any angle of 360 deg



NEW KEMPSMITH MILLING ATTACHMENT.

being graduated and its construction requires only two bolts to be handled in adjusting and clamping the head securely at any angle. Both bolts are very conveniently located.

The horizontal bolt clamping the head in the bracket has unusually rigid clamping power, being a friction bolt of improved type. The vertical spindle has taper hole, and is threaded for large face milling cutters. Both the taper hole and thread are the same as on the main spindle, thus making all tools interchangeable. Drawbolts are furnished for drawing in and backing out of end mills, the advantage in this being well known. The design of the head keeps the distance from the centre of the horizontal spindle to the nose of vertical spindle very short, so as to permit of doing work unusually high from the table.

The attachment is drilled to the same jig as the columns of machines for which it is intended, so that it can be applied to any Kempsmith miller, of certain sizes, now in use. The attachment is built in three sizes. The European agents of the company, Messrs. Selig Sonnenthal and Co., have the Kempsmith machines and attachment on view in London.

INDIAN COAL SUPPLIES.

The total Indian coal output last year amounted to 8,216,700 tons, and the industry generally is showing rapid development, but according to a Times correspondent, too little attention is given at Indian collieries to the preparation and selection of coal for the markets. In the near future, he says, Japan will compete more vigorously for the Eastern markets, and, unless Indian exporters specially select coal for the eastern ports, the result will be that the Japanese coal will oust the Indian qualities. The competition at most of the eastern ports will lie between India and Japan. Of late years reports have been published stating that Indian coal mines provided a profitable field for mechanical coal cutting, but from observations which the correspondent has made, on the spot, there seems little hope of introducing mechanical coal cutters successfully. Indian coal seams are thick, the general method of working is unsuitable to machine cutting, and native labour is extremely cheap. The cost of machine cutting in India, as taken from an actual example, was found to be double the cost of hand labour.

NEWS ITEMS.

The Swiss Government has sent two experts to the United States to study electric railway methods. These gentlemen are W. Wyssling, of Zurich, secretary-general of the Swiss commission for the study of the electrification of railways and commissioner of the Swiss government for electric railway studies; and Charles Wirth, of Berne, Swiss government engineer. Their visit is supposed to have some connection with the Swiss government plans to electrify the government lines, and to operate them from water power plants, utilising the mountain streams as a source of energy. Their route of travel will include Boston, Schenectady, Buffalo, Detroit, Chicago, Cleveland, Pittsburg, Baltimore and other places.

A conference of the unemployed is being called by the London Trades Council, and will probably be held on September 30th.

London statistics, 1904-1905, issued by the County Council, shows that there are 18 tramway undertakings in Greater London, with a total length of 188 miles, of which 115 are within the County of London. More than 400,000,000 passengers travelled on 2,000 tramcars in the metropolitan area, of whom 156,000,000 used the Council's cars. The result of the year's working, as regards the municipal system, was: gross receipts, £536,239; working expenditure, £442,986; gross profits, £92,253.

The output of quicksilver in the United States during 1904, as reported to the United States Geological Survey, was 34,570 flasks, valued at $1,503,795. The production of 1904 showed a decrease on that of 1903, which amounted to 35,620 flasks, valued at $1,544,934. The United States is now the world's leading producer of quicksilver.

FOUNDRY PRACTICE.

By Richard Moldenke.

LABORATORIES in foundries are still few and far between. Only the large works possess them, and have good men to get results. The smaller foundries plod along cheerfully without troubling their heads much about the chemistry of iron. Arrangements are now being made to protect the large as well as the small man, by means of standard specifications, so that he who really wants to be on the right side for right's sake, can do so without going to elaborate and expensive arrangements at his works. The commercial laboratories can then see that the specifications are lived up to, and the chances of failure are greatly diminished.

CALCULATION OF MIXTURES.

To enable a production of uniformly good castings to be made, the materials must necessarily be uniform in the first place, and the pig iron, coke, and other supplies which come in regularly should be investigated. Unless one knows just what is happening in the melting process used, he will not be able to make his mixtures properly. It is better, therefore, while analysing the material coming in, to study the composition of the castings made which have turned out to be first class. If, for instance, the analysis of a series of good boiler castings shows that they should contain about 1·90 per cent. silicon, not over 0·05 per cent. sulphur, and not over 0·40 per cent. phosphorus, the carbon and the manganese being those of normal irons, then the mixture must contain the silicon wanted, plus that burnt out during the melting (about 0·25 per cent.). The sulphur of the mixture must be at least 0·01 per cent. lower, as this amount is always added by the unavoidable contact with the fuel. The phosphorus need be but slightly lower, as the melting acts somewhat in the way of concentration, the bulk of the heat becoming four to seven per cent. smaller. This percentage by the way, is called the melting loss.

In the calculation of mixtures, we have the following elements to deal with: pig iron, scrap of various kinds, the fuel, and limestone as the flux. The pig iron may be either cast in the furnace sand bed, or else in chill moulds, or arranged from the furnace casting machine. Again, the pig iron may be either charcoal, coke or anthracite metal; that is, produced with these materials as fuel. A further differentiation gives us cold-blast [illegible] excellence being from the finest cold-blast charcoal irons down to the poorest cinder-made hot-blast coke irons. The mixture to be made may contain only one variety of pig iron, or else can be built up mysteriously out of twenty-three ingredients in the pig-iron line.

Building up a mixture intelligently has been one of the best accomplishments of science as introduced into foundry practice. The chemical composition is the basis of all the preparation of heats for making castings, whatever fine points may follow as indicated by the physical characteristics of the material in hand and the desired product. Thr Foundrymen's Associations, guided by technically trained men, have brought about a gradual revolution in the practices of buying and selling pig iron, so that now at least three quarters of the iron produced changes hands on a basis of chemical analysis, whereas formerly it was its fracture.

Granted that the foundry metallurgist has proven to his satisfaction that the analyses furnished by the furnaces with each carload of iron are in the main correct, he will nevertheless take the precaution to pile the metal in such a way that he is sure of uniform material when he uses it. If this is carefully done a very satisfactory arrangement ensues, and one can build up a mixture at the desk and be sure that it will work out all right, without troubling to see it.

In general, the more scrap used, the cheaper the mixture, but conversely, the less scrap used the better the meltin g loss. So a good mean must be selected, and this is usually 60 per cent. pig, and 40 per cent. scrap. This is for general jobbing castings; special classes of work often require pig iron wholly.

SILICON PERCENTAGE

Now in figuring a mixture, suppose that a good limit for the silicon has been found to be 2·15 per cent. for the castings. Then the 0·25 per cent. lost in melting added would mean 2·40 per cent. in the mixture. Let us say the cupola is charged up in 4,000 lb. layers of metal with the coke ratio 1 to 8 of iron. Of these 4,000 lb. of metal which should, at 2·40 per cent. silicon, contain 96 lb. of silicon, the pig iron is to form 60 per cent. of the charge and the scrap the other 40, or 2,400 lb. should be pig, and 1,600 lb. scrap. Now scrap is always considered to contain a little less silicon than the castings of the particular class from which the scrap originated, as no sane founder buys say, stove plate scrap, with its high phosphorus, to mix into boiler work where specifications are the order of the day, and sound, strong metal is imperative. Hence for our purpose the scrap may be considered to contain 2·00 per cent. silicon. It is manifestly impossible to analyse every piece of scrap used, hence the necessity for arbitrary figures. Our scrap, 1,600 lb. at 2·00 per cent. equals 32 lb. of silicon. We now have 32 of the 96 lb. accounted for, and hence the pig iron must contain the other 64 lb. which with 2,400 lb. would approximate a silicon percentage of 2·65. This example, which, by the way, is that of soft machine castings of medium size, shows that the yard must contain irons of higher silicon content than those given before. We must have our irons run 2·00, 2·25, 2·50, and 2·75 per cent. silicon in this case. Continuing the example we note that with pig irons averaging 2·65 per cent. silicon wanted, the mixture will be between the 2·50 and the 2·75 limits. Hence a simple trial calculation will show that it takes 2,000 lb. of the 2·75 per cent. silicon iron and 400 of the 2·50 per cent. silicon iron to do the trick. The mixture will therefore look like this :—

1,600 lb.	scrap, 2·00 per cent. Si	32·0 lb. Si.
2,000 lb.	pig iron, say Warwick, 2·75 per cent. Si.	55·0 lb. Si.
400 lb.	pig iron, say Clifton, 2·50 per cent. Si.	10·0 lb. Si.
4,000 lb.	Average 2·40	96·0 lb. Si.

It is also advisable to have some 4·00 to 5·00 per cent. silicon iron in the yard, say a carload at a time, in order to correct a too sudden tendency downward in the silicon of the mixture, as the result of improper working of the cupola or furnace. This also enables one to use lower silicon and therefore cheaper irons in the mixture. It is, however, not conducive to good results ; the old maxim of putting into the cupola or furnace as nearly as possible the material one wants to get out of it, holds good in spite of all our advances in the science. It may further be added that if any steel is to be put into the mixture, the silicon must be correspondingly increased, as steel contains only a negligible quantity of this element.

CHARGING THE CUPOLA.

In charging up the cupola, after the bottom has been carefully prepared, and the coke bed lighted up with shavings and kindling wood, the bed is brought up to the proper height, and charging commenced. The bed is usually made with a ratio of four to one, that is for a 4,000 lb. charge of metal, 1,000 lb. of coke goes in. This is, of course, for a good-sized cupola. Now after the first charge, the ratio is made ten to one, in fact the calculations are made so that the average of the whole heat is about one of coke used to melt eight of iron. The small coke charges between the batches of iron serve to keep the bed of coke underneath the whole heat at the proper height, it being essential to have over ten inches of coke above the tuyeres, otherwise the wind comes into contact with the iron too soon, and either chills or burns the metal. In charging steel scrap, this must be selected from boiler plate, rails, structural material, or steel castings, if obtainable. It must be neither too thick nor too thin, otherwise an irregular melting will result. Twenty-five per cent. is a good amount to use for very strong work. It can be raised up to 40 per cent. if desired, but everything above the 25 per cent. will take up so much carbon from the fuel that the value as a reducer of the total carbon is gone. Where much steel is used, from 2 to 4 per cent. of ferro-manganese should be put into the ladle, as the added steel makes the melting point of the metal go up, and hence ferro-manganese gets in its work as a deoxidiser, a thing which is not practical with the low temperatures of ordinary grey irons.

KEEPING DOWN THE SULPHUR.

We have so far only looked at the silicon. The sulphur is another important matter in a casting. Sulphur is the worst enemy of the foundrymen. It must be kept low, or there will be trouble in light castings. The calculation of sulphur in a mixture is similar to that given for silicon, but if precaution is used and the pig irons are kept low in this element, it need not be considered in the mixture calculations. Not only have we to contend with the sulphur of the pig irons, but also of the coke or anthracite, if this is used ; the latter, however, giving far less trouble than the former. From 0·01 per cent. all the way up to 0·07 per cent. is added in the cupola, depending upon the sulphur in the coke and also its state in this material. It seems that only the sulphur which is in the ash of the coke goes into the iron, and especially when the heat is run cold. It is therefore best to use plenty of fuel to get good hot iron, as the chances are that much of the sulphur is driven off before the damage is done as well as a better reaction had between the limestone and the impurities to be slagged off.

FUEL.

Anthracite, making a good hot fire, is a good melting fuel, where the price is not prohibitive, and belongs in the bed, the subsequent charges being of coke. In the air furnace, naturally only very rich bituminous coal can be used as a very long flame is wanted. In spite of only an indirect contact with the fuel, the iron of the bath will absorb some sulphur, and I have noted where a coal ran over 3·00 per cent. in sulphur, that the [illegible] with only [illegible] per cent. sulphur originally came out with [illegible] per cent. and was worthless. Only a very basic slag made with an excess of limestone held this sulphur down to safety, until other coal was procured. As a side remark it may be added that the air furnace is becoming used more and more where a better grade of castings is wanted.

From the study of the daily mixtures and all that falls within this realm, the next important step taken by the technical man in the foundry is the purchase of the iron and fuel. The metallurgist is the most useful adjunct the purchasing agent of an establishment can have.

While the importance of silicon and sulphur has been specially dwelt upon, it is their effect on the relation of the carbon content in a casting that is really aimed at. Whether a piece of cast iron is grey and soft, grey and hard, mottled or white, and only amenable to the emery wheel, depends upon the proportion of combined carbon present out of a high or low total carbon. Thus with 3·5 per cent. total carbon, 0·20 per cent. of which is combined, 3·30 per cent. being graphite, the casting is practically a twenty carbon steel, with a big amount of graphite to lubricate the tool which cuts it, and at the same time weaken the structure. This is a soft grey iron casting. Run the total carbon down to say 2·80 per cent., but keep the combined carbon the same and we have a much stronger grey iron, which is still soft, and almost as easy to machine. Now if you run the combined carbon up, you make a tool steel of the matrix, with whatever graphite is present to weaken the structure. The metal, however, is now hard to tool As the combined carbon is carried to the full amount of total carbon, we get the white irons, which are used for rolls, malleables, and usually require subsequent heat treatment to become serviceable in the industry.

THREE IMPORTANT VARIABLES.

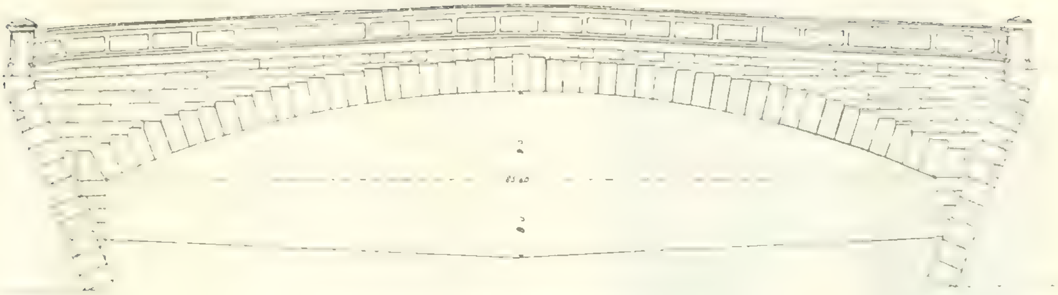
The state of the graphite and the combined carbon of a casting is the direct result of several variable conditions. First the silicon content (and in a lesser measure the sulphur), which when above 1·75 per cent. makes grey to black fractures in a casting, and when below may make from light grey to dead white, according to circumstances. The second variable is the thickness of the casting which controls the cooling rate of metal after it is poured. Lastly, the temperature of the metal has its effect. A hot pour always makes harder iron than a dull pour.

The combination of these three variables is the sum of our results in the foundry, and a careful balance brought to bear on the mixture made, is what puts the value on the man in charge. Naturally it takes years of experience to handle these points with confidence and accuracy, but it is only by trial that one learns.

The metallurgical problems in the foundry are by no means easy nor few. For in the making of a good mixture is not a guarantee that the castings will be right, for after tapping there are a lot of opportunities of spoiling good work.

Abstract of a lecture delivered at the Case School of Applied Science Cleveland.

[illegible] GRAND BRIDGE, [illegible], WITH A PORTION OF THE NEW SPRUIT.



TYPE OF BRIDGES OVER BLOEMSPRUIT.

SOUTH AFRICAN NOTES.

FLOOD PREVENTION AT BLOEMFONTEIN.

In March last a plan appeared in Page's Weekly showing the course of the new spruit which is being cut through Bloemfontein to protect the surrounding property from floods. It will be remembered that the Council decided to excavate a new straight cut 100 ft. wide at the top and nearly a mile long, the scheme including the construction of six new stone bridges. The Transvaal Engineering and Contracting Company, Ltd., have made good progress with this work since October, 1904. President Brand, Street Bridge and Fraser Street Bridge, are now both open for traffic, while at Harvey Road Bridge both abutments are completed and the arch is in course of construction. The Gordon Street abutments are ready for the arch.

The accompanying view of President Brand Street Bridge shows the stone pitching of the new spruit, which is of an average height of 20 feet on the slope. All the arches, six in number, are of masonry, with [illegible] of [illegible] ft. and a rise of [illegible] ft.

The voussiors, groins, face work and parapets are of Marseilles stone (a sandstone of excellent quality, of a dull yellow colour), obtained from quarries near Ladybrand, about seventy-two miles by rail from Bloemfontein. The other stone work employed on the bridges is obtained from quarries belonging to the Corporation of Bloemfontein, situate at Waaihock, a native location on the south-east side of the city. The stone is brought from Waaihock by traction engines.

The new spruit will be quite straight from beginning to end, and the six bridges all on one central line will [illegible] a very good effect. The total amount of the contract is [illegible] and the value of the work executed from October 6th, 1904, to August 8th, 1905, was [illegible]

The total value of works authorised and executed for the City of Bloemfontein under the direction of the city enginer during the last three years amounts to £500,000.

FLOODS AT THE GAMTOOS RIVER.

A wire from Hankey, Cape Colony, states that the irrigation works on the Gamtoos River have been destroyed by the floods. The damage done is more extensive than has hitherto been realised. Thousands of acres under cultivation are submerged 10 ft., and the valley of the Gamtoos is converted into a lake extending for miles.

H. E. [illegible], M.INST.C.E.,
City Engineer, Bloemfontein.

J. WOODWARD HILL, A.M. INST. C.E.,
Chief Assistant Engineer, Bloemfontein.

TUBE MILLS ON THE RAND

The tangible improvements which have accrued from the installation of tube mills on the Robinson Deep are detailed by the Johannesburg correspondent of the African World as follows:—

1. The gold recovery has been increased by nearly 3 per cent.

2. Approximately five-eighths of the gold saved from going to the waste dump represents additional profit.

3. Upward of 1,300 tons per month are being crushed by the 200 stamps in excess of former tonnages, owing to the coarser mesh screens being made economically practicable.

4. The combination of increased extraction and higher crushing capacity (and consequent reduction of working costs) have resulted in raising the mine's output from £61,547 to £64,345; and profits from £28,249 to £34,125 per thirty-one day month (March and July figures).

According to this authority the liner question gives less trouble than was generally feared. Both manganese steel and silex liners have been employed experimentally but owing to the cost of the former the use of the silex has now been definitely adopted. The life of this variety of liner may be set down at sevenor eight weeks, and the maintenance costs amount to about £130 to £140 per month for the two mills. The stoppages necessitated for internal repairs of linings constitute weighty factors militating against the full efficiency of the plant, but this will not apply to future installations as proposed for the majority of mines on the Rand. The Robinson Deep installation is incomplete in that there is no reserve mill, both tubes being required to work constantly at full pressure to satisfy as far as possible the needs of the battery. When it is understood that the shortest stoppage for liner replacement has been, so far, of four and a-quarter days' duration, the importance of a standby needs no special reference. A good deal of experimenting has been undertaken at the Robinson Deep in connection with the pebbles used for grinding. The expense of the imported flints, which cost £8 per ton and involve an expenditure of £100 per month, naturally makes the discovery of a suitable local pebble highly desirable. The well worn pebbles of the Elsburg series have been tried but their comparatively rapid consumption makes them no cheaper than the imported stones when estimated on the tonnage-reground basis. A most interesting experiment is now being made with pieces of banket as a grinding agent, but sufficient work has not yet been performed therewith to permit of positive judgment as to the efficacy of the scheme. The saving in cost is, of course, very considerable, but investigations over a long period will alone determine whether this is not balanced by a loss in grinding capacity. Similarly, local flinty chert is to be tried for liners in place of imported silex blocks.

PROPOSED WATER POWER PLANT IN BAVARIA.

A despatch has been received from H.M. Consul at Munich (Mr. L. Buchanan), giving particulars of a new scheme to obtain water-power in the mountains of Upper Bavaria from Lakes Walchen (802 metres) and Kochel (600 metres). The project consists of making use of the difference of the 200 metres (about 660 ft.) between the level of the two lakes to produce the greatest hydraulic power for generating electricity Germany will possess. The turbines would be established in Lake Kochel. The power obtained by this natural fall is calculated to equal 20,000 h.p. The scheme includes the building of a canal between the two lakes, the tapping of the river feeding Lake Walchen, the construction of a weir etc.

The pipe plant used in connection with the Dudley Port Power Gas Distribution scheme is similar to that employed for the Coolgardie Waterworks scheme. The pipes are tested to a pressure of 300 lb. per square inch, and after being coated with two layers of bitumen, between which is one of brattice cloth, are ready for laying, the joints being protected in the same way. As an additional precaution against corrosion where the roads are made of cinder, they are laid in a troughing of clay.

USES OF ELECTRICITY IN MINES.

By Henry Willock Ravenshaw, A.M.Inst.C.E., M.F.Inst.M.E.

(Continued from page 543.)

LIGHTING.

THE electric lighting of a colliery is generally independent of the power plant, and, as a rule, a continuous service is maintained. A pressure of 2[illegible] volts direct current is usually employed, and the shaft cables (in some cases 600 to 1,000 yards long) have to be of ample section to prevent an undue drop of pressure.

It is excellent practice to have a separate dynamo for supplying the underground lighting. It is a curious fact that even in a damp mine it is easier to maintain a good insulation underground than on the surface. Where motors are used at a considerable distance from the pit bottom, it is very convenient to light the engine rooms and the adjacent roadways by lamps, in series, on the power mains. Electric accumulator lamps are sometimes employed, but they are not very largely used, the extra weight and first cost being against them.

Electricity has also been applied to the lighting of the ordinary oil safety lamps.

SIGNALLING.

Electric signalling bells have now become very popular, and in some cases as many as twenty primary cells are used on a circuit. In order to prevent danger from sparking at the contacts, the new Home Office rules limit the pressure on signalling circuits to fifteen volts in fiery mines. The bells and keys are generally fitted so as to be dust and damp tight. On roads where mechanical haulage is employed, two bare wires are stretched overhead at such a distance that they can be pinched together with the hand. These wires are connected to a bell circuit so that signals can be transmitted from any point on the roadway to the engineman. The cost of primary batteries in a large colliery is considerable, and amounts to as much as £80 a year for material alone.

FUSES.

Two systems are in general use in shot firing for electrically igniting the fuses, namely, the low tension and the high tension. In both cases magneto generators are generally used, which are turned by hand, but, in the case of shaft sinking, shots are frequently fired from the lighting circuits. In the case of the low tension, the current heats a fine platinum wire which fires the detonating charge. A pressure of only a few volts is employed, and when several shots are to be fired the fuses are arranged in series. With this system it is possible to test for continuity of circuit, but this advantage is somewhat discounted by the fact that it is practically impossible to distinguish between a complete circuit and a short circuit. Batteries, either primary or secondary, are sometimes used for low tension fuses. With high-tension ingition the points are a short distance apart, and they are generally coated with conducting and inflammable chemicals. A pressure only of from 30 to 150 volts is required, and it is probable that an arc is actually formed. In this system the fuses are arranged in parallel. High-tension fuses are somewhat cheaper than low-tension, and appear to be the more popular with the officials who have to use them.

CHOICE OF SYSTEM.

Both direct and alternating currents have been largely used in mines with success, but experience points to the fact that the alternating system is the more suitable. Where large powers are required, the difficulty in breaking heavy direct currents in enclosed boxes is very great; oil switches cannot safely be employed owing to the quick break causing a heavy rise of potential in the circuit, and the same objections apply to magnetic blow-outs.

With alternating currents oil switches can be safely used, and this one point alone is sufficient to give that system a great advantage. The absence of brushes and the possibility of using squirrel cage motors is also an advantage, although the modern motor gives very little trouble at the commutator.

High pressures have no great advantages for use inbye, as the distance from the distributing centre is not, as a rule, more than two to three miles, or well within the economical limit for a pressure of 500 volts.

ENCLOSED MOTORS.

It is of absolute importance that the safety of the mine is ensured. The question of enclosed motors is an important one, and the experiments made by Mr. W. E. Garforth, and described by him in his evidence before the Home Office Committee, appear to cover the whole ground.

It is possible to run an entirely enclosed motor, the covers being machine-faced and efficiently gas-tight, in an explosive mixture for one hour without ignition. An unenclosed direct current motor will ignite gas. If an enclosed motor is surrounded for fourteen hours by an explosive mixture the gas may diffuse it into the case and cause an internal explosion. The internal explosion above-mentioned will not of necessity ignite the external mixture.

THE FLEXIBLE SUSPENSION OF CABLES.

Although any new regulations are sure to cause a certain amount of hardship on those who come within their sphere, colliery owners having properly-installed plants have been put to very little expense in complying with the new rules. Rule 6, Section III., which requires that leather or other flexible material shall be used for suspending cables underground, is the only one which is likely to cause any real hardship. This rule is of course of somewhat "cast-iron" character, as hundreds of miles of cables are already fixed up by cleats, and in many places, especially where there is very little room, competent colliery managers are of opinion that a flexible suspension is not suitable.

QUESTIONS OF COSTS.

The questions of capital expenditure and running cost are of the greatest importance, and it may be safely said that where proper economy has not been exercised in putting down a plant, there will be likely to be found heavy working costs and unreliable running.

For colliery work the plant must be of the highest quality, but simplicity of design is of the greatest importance. Where steam engines are used an excellent electric generating plant, suitable for a works or colliery, can be put down for £22 per kilowatt output. A gas engine plant using coke or anthracite would cost £24 per kilowatt, and if coke-oven gas is used £22 per kilowatt. An exhaust steam plant of the Rateau type would probably cost from £18 to £20 per kilowatt.

These figures are taken from actual practice and make no allowance for spare plant. A margin of about 20 per cent. is generally allowed for spares. Depreciation, and interest on capital expended, are items that are of the greatest importance in calculating costs.

COAL CONSUMPTION

With regard to coal consumption it must be remembered that although coal may be cheap, boilers cost money to put down and maintain. I have gone rather thoroughly into this question, and I find that, on an average, for every ton of coal burnt, the costs for labour, boiler repairs, depreciation and interest on capital, amount to at least 2s. 6d., consequently even if the coal cost nothing, a ton saved per day would mean a saving of at least £40 per annum. In large collieries from 50 to 80 tons a day are burnt under the boilers, and in many cases it is practically certain that this consumption could be reduced by one half.

The following consumptions if obtained all the year round are not likely to be improved on with a 200-kilowatt plant working 16 hours a day: Steam engines 5 lb. per kilowatt, gas engine with anthracite, 1·85 lb. per kilowatt; gas engine with coke, 2·25 lb. per kilowatt.

The costs with a good load factor should not exceed:—

Coal and boiler or producer charges	0·20d.	per unit
Labour, stores, repairs ..	0·15d.	
Depreciation and interest ..	0·25d.	
	0·60d.	

THE REDUCED COST OF ELECTRICAL MACHINERY.

With a plant of double the size, the costs can be reduced to 0·5d. per unit. When it is considered that with a 200-kilowatt plant working for ten hours a day, a saving of 1-10th of a penny per unit means £250 per annum, the importance of economy is evident. The fact that the cost of electrical machinery has been enormously reduced in the last ten years, is of great advantage to power users, and has given an enormous impetus to electrical transmissions. A slow speed 40-h.p. motor which used to cost £220, can now be bought for £100 or about £2 10s. per h.p., a great contrast to high-class steam engines which cost about £5 per h.p.

In putting down an electrical power plant the cost of the generating station must be considered, but it is an interesting fact that where there are a good many motors working on variable loads the demand seldom exceeds one-half of their aggregate maximum capacity. For instance, a 500 horse-power dynamo will generally be sufficient to supply current to 1,000 horse-power of motors.

I am convinced that a colliery of fair size can generate electricity for its own use at a considerably lower rate than a public supply can afford to sell it at a profit if a proper allowance is made for depreciation in both cases.

The advantages of the use of electricity in mines is in many cases obvious, and it is certain that as new collieries are opened out, and old ones reorganised the electric motor will be almost universally used; in fact I feel fairly safe in saying that where compressed air has to be used the air compressors of the future will be electrically driven in the mine itself. With regard to winding, a great deal has to be done in devising simple and economical electrical methods before they are generally adopted, but it is more than likely that this class of plant will be of great importance in the future. Electrical driving is being almost universally adopted all the world over, for its all-round economy and convenience, and these advantages are being rapidly appreciated among mining engineers.

Abstract of a Paper read before the Society of Arts

SHIPBUILDING NOTES.

FROM the Wallsend Shipbuilding Yard, Messrs. Swan, Hunter, and Wigham Richardson, Ltd., have launched a steel-screw steamer for the Hall Line service of the Ellerman Lines, Ltd. The dimensions of the vessel are: length over all 389 ft., beam extreme 47 ft. 5 in., and depth moulded 30 ft. 11 in. She has a poop, bridge and forecastle. The vessel has been designed to carry a deadweight cargo of about 7,000 tons on a moderate draught of water. The machinery has been constructed by the Wallsend Slipway and Engineering Company, Ltd., and consists of a set of triple-expansion engines, having cylinders 23½ in., 40 in., and 69 in. by 48 in. stroke, steam being supplied by two single-ended boilers fitted with Howden's forced draught, and working at a pressure of 212 lb. per square inch. The vessel is being built to the rules of the British Corporation for the Survey and Registry of Shipping, and will take their highest class. She is being constructed under the supervision of Mr. Alexander Dalrymple, the superintendent engineer of the Ellerman Lines. On leaving the ways the vessel was named the *Langton Hall* by Miss Beryl May Gill daughter of Mr. George Gill, director of the Hall Line.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Saturday, the 16th inst., the steel-screw trawler *Pelican*, the principal dimensions being 114 ft. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. The Cleethorpes Steam Trawling Company, Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes.

On Friday, September 15th, Messrs. William Gray and Company, Ltd., launched the steel-screw steamer *Twilight*, which they have built to the order of Messrs. John Wood and Company, of London and West Hartlepool. She will take the highest class in Lloyd's and is of the following dimensions: length overall, 342 ft., breadth 47 ft. 6 in., and depth 24 ft. 9 in., with long bridge, poop and topgallant forecastle. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers working at 180 lb. per square inch. The ceremony of naming the steamer was performed by Miss Harriett Wood, of West Hartlepool.

On Saturday last the steel-screw steamer *Queen Amelie*, built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. Thomas Dunlop and Sons, Glasgow, left the Tyne for her trial trip. The steamer is the fifth built for the above company, and is 382 ft. long by 48 ft. beam by 30 ft. 8 in. deep, and has been built under special survey to the highest class at Lloyd's spar deck rule with extra strengthening for special freeboard. The machinery has been supplied by Messrs. The North-Eastern Marine Engineering Company, Ltd., Wallsend, consisting of engines with cylinders 24½ in., 40 in., and 68 in. by 48 in. three large boilers 13 ft. 9 in. by 11 ft., 180 lb. working pressure. The steamer will carry 7,200 tons loaded. During construction the *Queen Amelie* has been superintended by Mr. Broom and Mr. McIntosh. The trial trip proved in every way satisfactory, a speed of 12¼ knots being easily obtained.

On Wednesday, the 13th inst., the steel-screw steamer *Claverhill*, built by Messrs. Craig, Taylor and Co., Ltd., Stockton-on-Tees, to the order of Messrs. E. Haslehust and Co., London, was taken to sea for her trial trip, which proved very satisfactory. The vessel is of the following dimensions, 369 ft. by 49 ft. by 28 ft. 9 in. moulded. She is built of steel to the highest class in Lloyd's under special survey, with poop and bridge combined, and topgallant forecastle, water ballast in double bottom fore and aft, and in peaks. She has been built on the deep-frame principle, giving large clear holds for stowing cargo, with large hatches, and is rigged as a fore and aft schooner. The engines, which have been constructed by Messrs. The North-Eastern Marine Engineering Company, Ltd., have cylinders 26 in., 42 in., 72 in. by 48 in. stroke, with three large steel boilers working at 180 lb. pressure, and over a course of six miles, a speed of 12½ knots was maintained.

There was successfully launched from the yard of the Caledonian Engineering and Shipbuilding Company, Preston, on Thursday, a steel-screw tugboat, 70 ft. by 6 ft. by 8 ft. 9 in., built to the order of Mr. Albert Westcott, of Plymouth. The vessel was christened the *Herbert*, by Miss Thornborough, in the presence of a large number of spectators. The company are at present very busy, having several other vessels on the stocks.

The *O*[illegible] was launched by Swan, Hunter and Wigham Richardson, Ltd., on Thursday, the 14th inst. from their Neptune Shipyard, Newcastle-on-Tyne. This vessel is being built to the order of the Deutsch-Australische D.G. of Hamburg, for their Australian service. She is of steel, 386 ft. in length by 50 ft. beam, and will attain the highest class in Lloyd's Register. A special feature of the steamer is that large provision is made for the carriage of meat, etc., at a low temperature, a very complete system of refrigerating machinery being fitted. The engines are of the quadruple expansion type, and are constructed on the Yarrow Schlick and Tweedy system. They, together with the boilers, are being built at the Neptune Works of Swan, Hunter, and Wigham Richardson, Ltd. The launch was witnessed by a large company including Capt. Hahn and Mr. Steffen of Hamburg, representing the owners. The christening ceremony was performed by Miss Elsie Tweedy, of Kelso House, Newcastle-on-Tyne.

On Wednesday, September 13th, Messrs. R. Craggs and Sons, Ltd., launched from their Tees Dockyard Middlesbrough, a fine steel cargo steamer, 358 ft. 6 in. long, 50 ft. 8 in. beam, 25 ft. 6 in. depth moulded. This vessel is being built under special survey in excess of the highest class under Lloyd's three-deck rule with one deck laid having poop, bridge and forecastle. The machinery will be fitted by the North-Eastern Marine Engineering Company, Ltd., of Sunderland, and will have cylinders 25 in., 42 in., 68 in. by 45 in. stroke, steam being supplied by two large single-ended boilers working at 180 lb. to the square inch, 16 ft. 9 in. diameter. The vessel has been built to the order of The English and American Shipping Company, Ltd. (C. T. Bowring and Co., Ltd., managers), of London, and on leaving the ways was named *Zafra* by Miss Hay, of Sacombe Park, Herts., daughter of one of the directors of the company. The specifications have been supervised and the construction of the hull and machinery has been superintended by Messrs. Jacobs and Barringer of London, [illegible] all

On the 14th inst. there was launched from the shipbuilding and repairing yard of Messrs. S. P. Austin and Son, Ltd., Sunderland, the steel-screw steamer *Lord Stewart*, which has been built to the order of Mr. S. J. Ditchfield, of Seaham Harbour. The vessel is designed to carry 2,200 tons deadweight capacity on light draft. She will be classed 100 A.1. in Lloyd's Register under special survey, and will be specially adapted for quick loading in the coal and general trades. The triple-expansion engines will be supplied by the North-Eastern Marine Engineering Company, Ltd. The deck machinery, including steam winches and patent quick-warping windlass, is by Clarke, Chapman and Co., Ltd., and the steam steering gear by Donkin and Co. The ship and machinery have been constructed under the superintendence of Mr. Chilton, of Seaham Harbour. The ceremony of naming the vessel was performed by Mrs. Brough.

On Thursday, September 14th, Messrs. William Gray and Co., Ltd., launched the steel-screw steamer *Harlech*, which they have built to the order of London owners. She will take the highest class in Lloyd's and is of the following dimensions: length overall, 353 ft. 6 in., breadth 49 ft. 6 in. and depth 25 ft. 2 in., with extra long bridge, poop and topgallant forecastle. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25½ in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lb. per square inch. The ceremony of naming the steamer *Harlech* was performed by Miss Freda M. Harrison, of Sydenham, London.

At Darlington forge on Saturday, two large stern frame castings for two new Cunard liners were inspected. These vessels are being built by Messrs. J. Brown and Co., Clydebank, and Messrs. Swan and Hunter, Wallsend, and will be the largest vessels afloat. According to a Times correspondent the stern post made at Darlington forge for these vessels weighs 47 tons, the after brackets 22½ tons each, and the forward brackets 24 tons each. The total weight of the rudder will be about 70 tons. A charge of 70 tons molten steel was required in casting the stern frames, and the total weight of the castings, including the stern frame hatches and rudder, is about 220 tons. These castings, which are stated to be the largest ever produced in England, will very shortly be ready for dispatch to the shipbuilders.

INSTITUTION OF MINING ENGINEERS.

ANNUAL GENERAL MEETING.

(*Continued from page 597.*)

EARTH IN COLLIERIES.

Mr. Sydney F. Walker read a paper on this subject of which the following is an abstract :—

Three points appear to be evident from the special rules for the installation and use of electricity in mines.

The object of the departmental committee in all the special rules, is to minimise the danger of shock, and of fire, but principally of shock ; to keep "earth" completely out of any electric system in use in collieries ; and, to ensure that under no circumstances could anyone about the mine place himself in such a position that a dangerous current could pass through him, or, in other words, that no dangerous pressure should exist between the ground, floor, etc., that men about the mine must stand on, and any object they might touch. The writer proceeds to consider how far the objects of the departmental committee have been, or are likely to be accomplished by the working of the special rules.

Water-pipes, tram-rails, and wire-ropes, will play an important part in coal-mines in the conduction of any currents that are delivered to earth, but the strata themselves will also perform their share, in strictly inverse proportion to their resistances.

Coal has a very high resistance, bearing comparison, in fact, with some of the substances employed for insulation ; and it follows that any conduction that takes place must be, for practical purposes, by the tram-rails, water-pipes (where they are present), wire-ropes, assisted, as far as they can assist by the "thill" this having an enormously lower resistance than the coal.

In the great majority of cases, a man receives a shock in a coal-mine, because his feet, being already in connection with a conductor, his hands, his body or his head make contact with another conductor, between which and the one he is standing upon, there exists a sufficient electrical pressure to drive a dangerous current through him. Protection means, then, so arranging that he cannot, wherever he may be standing in or about the mine, come into contact with any conductor at more than a few volts difference of pressure from the ground, floor, or whatever he may be standing on. There are two methods of accomplishing this, both of which are made use of in the special rules.

A large proportion of the possibly available pressure may be used up by the interposition of a high resistance in the path of the current through the man, or it can be accomplished by lowering the available pressure at all points where shocks can be obtained. In all of the special rules, the idea is, that all metal surfaces that anyone can possibly touch shall be placed at a very low difference of pressure from the ground, etc., that everyone about a mine must stand on. All metal surfaces that it is possible to touch are to be brought to such a condition electrically, that the difference of pressure between them and the ground on which men about the mine must stand, is reduced to very small figures, say less than 50 volts : this being accomplished by armouring all cables or enclosing them in pipes, enclosing all switches, and earthing all armour, pipes, frames of machines, etc.

CLASSES OF COAL MINES.

Broadly speaking, the coal-mines in this country may be divided into two classes, for this purpose ; those in which there is water in the workings, with pumps and water pipes leading from the pumps to the shafts ; and those in which there is none. In the former set of collieries, earth means the water-pipes, plus the tram-rails, and the strata on which they are laid ; and efficient earth means good electrical connection between the water-pipes, and the ground upon which men may be standing when they may grasp a cable, or other conductor ; and good electrical connection between armour, etc., and the water pipes. As there is usually a good deal of water on the roads, when there is water inbye, the connection between the water-pipes and the floor of the roads is sufficiently good to call the latter good earth, for all currents of moderate strength, and therefore so far as protection is afforded by connecting to earth, it is obtained in these collieries, with currents of moderate strength. But it is a very doubtful matter, if protection is obtained by connection to earth, in this way, where earth is of the best of its kind.

It appears to the writer that if earth is to be admitted into the system, by far the best plan would be to adopt the system of concentric uninsulated return. With that there is no question of obtaining good earth ; the return path is necessarily perfect, or the system cannot work.

This system can be applied to three-phase as well as to continuous current.

The special rule (Section VI. of Rules) affords a striking commentary on the whole question. If electric locomotives are established in coal-mines in this country, and earth be permitted on the power-supply system, the currents will find their way from the locomotive system to the power system and *vice versa*, no matter how carefully the two are separated, if the insulation of either supply-cable breaks down.

It should be remarked also, that leaving out other matters, earthing any part of any system increases the probability of shock to attendants who have to trim brushes, see to fuses, etc., and this particularly applies to earthing the neutral wire of polyphase systems, etc.

EARTH: WHERE THERE IS NO WATER INBYE.

In the above paragraph, the author has dealt with the most favourable conditions for obtaining earth, but where there is no water in the workings, and where the mine is dry and dusty, it will be found very difficult to obtain earth at all. Earth, to be efficient, must be of sufficiently low resistance to make very little charge upon any pressure delivered to it, in other words, to allow the passage of currents freely through it. According to the measurements referred to above, by Mr. Wood, the resistance of coal runs from 33,000 million to 80,000 million ohms as against copper, 0·00015 ohm; while contact with the coal would be very difficult to obtain, and would add to its resistance. The resistance of the underlying strata, the thill or floor, is very much less, ranging according to Mr. Wood's measurements from 13,000 to 105,000 ohms. According to the measurement of Mr. W. Moon, of the Postal Telegraph Engineers' Department, the resistance of some clays is less, ranging from 2,500 to 23,500 ohms, when mixed with sand and gravel.

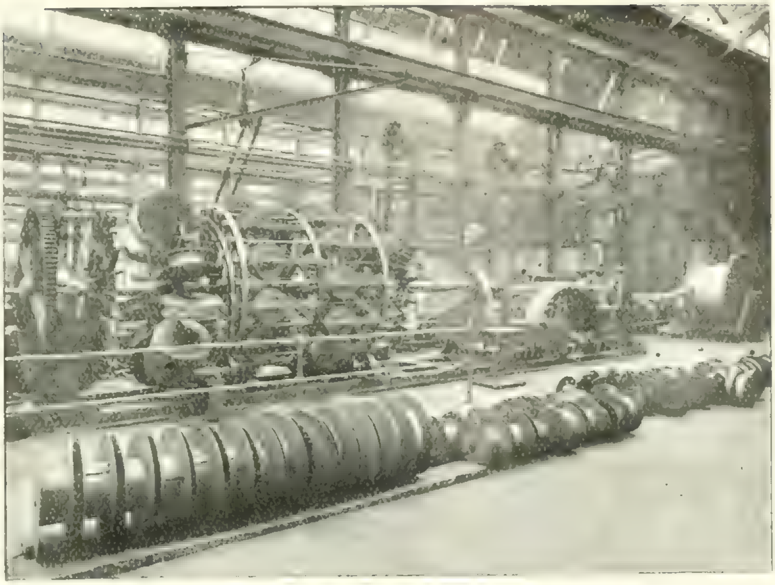
Apparently the only possible earth obtainable is by connection to the floor, and the actual earth-path will be by way of the tram-rails plus the floor itself.

The resistance of the strata forming the floor or thill varies directly as the length of the strata through which the current passes, and inversely as the sectional area. That is to say, the farther inbye all earth connection is required, the greater will be the resistance offered to the passage of current through the floor, and the thicker the strata, the lower will be its resistance. The resistance of a very thin floor will be very high, unless there is a strata underlying it, with which it is making good electrical connection, and which is of a comparatively low resistance. Faulting of the strata will also play a very important part in this matter, as the effective area of the floor available for the conduction of currents passing in the earth-path, will be bounded by faults, for practical purposes. The strata against which the floor abuts at a fault may be fairly conductive, but there will always be introduced into the earth-path a considerable additional resistance, owing to the passage of the current from one strata to the other.

MESSRS. GLOVER'S CABLE TESTING DEPARTMENT

RESISTANCE FORMULA.

As to the probable resistance of such an earth-path the writer has worked out the following formula for the resistance of the path formed by the strata alone, which it will probably be safer to assume as the path to be used for calculations: $R = SL \div WT$; R being the resistance of the strata between the point that is to be connected to earth, and the nearest point where really good earth can be obtained; S, the specific resistance per cubic inch of the floor, or whatever the strata may be, that forms the earth-path; L, the distance in yards between the point where really good earth may be



ELECTRIC STRANDING MACHINES AT THE WORKS OF MESSRS. W. T. GLOVER AND CO., LIMITED.

obtained and the farthest point where it is wanted; W the width in yards of the underlying strata between faults; and T the thickness of the same in inches. By specific resistance per cubic inch is meant the resistance between opposed faces of a cubic inch on the side. The writer has converted the figures to per cubic inch to simplify the calculation since all other measurements are in inches, feet or yards.

Taking the specific resistance per cubic centimetrel of the floor as 10,000 ohms; this is probably a low figure, and it equals approximately to 4,000 ohms per cubic inch; and taking a thickness of floor of 1 ft., and a width between faults of ½ mile, the author makes the resistance for a length of one mile of the strata, between the point where good earth is obtainable inbye, 666 ohms; for two miles, 1,332 ohms; and for ½ mile, 333 ohms. With a width of one mile between faults, the thickness being the same, the author makes the resistance, for one mile, 333 ohms; for two miles, 666 ohms; and for ½ mile, 166½ ohms. With the last values, if the thickness of the strata is only 6 inches, the resistance becomes again 666, 1,332 and 333 ohms respectively, and the other values all in proportion.

The matter is one for actual measurement, and the author understands that further measurements are to be made at the Armstrong College on the contact-resistances. Meanwhile, there is sufficient information to say that the probable resistances of earth-paths in dry and dusty mines will be absolutely prohibitive. To be efficient, the total possible resistance of an earth path that is to be capable of protecting on all possible occasions, should not exceed a small fraction of an ohm. The office of the earth-path, if it is to accomplish the object assigned to it by the departmental committee, is to neutralise all but very low pressures, under all possible conditions, and this can only be done, if at all, with the large currents that will be used, or that may have to be accommodated in the process, by a path of very low resistance. As mentioned above, if earth is to be admitted into the system, there is only one method of accomplishing what the departmental committee desire, by using the plan adopted by Messrs Mavor and Coulson of an uninsulated return, completely enclosing the live conductor. This plan can be arranged with three-phase by making one of the three conductors the uninsulated return, the equivalent of the arrangement on the railways using three-phase currents, the currents being delivered to the trains from two overhead wires, the rails being the equivalent of the third wire.

APPARATUS FOR RECORDING LEAKAGE.

In all the instruments on the market, the resistances of the insulating envelopes of the cables are represented by artificial resistances, equal in value, and both large, the two resistances being connected together at their ends, and the junction connected to earth, a very low-reading ampere-meter being inserted between the junction and earth. If the insulation resistance of either cable is lessened, the artificial resistance on that side is more or less bridged, or shunted, and the pressure between the opposite cable and earth is increased, with the result that a current passes through the instrument which measures, in certain units, that can be determined by experiment, and that are known to the designer, the leakage or the loss of resistance on the other side. When the insulation of both cables is perfect, the pressure at the junction between the two resistances should be zero, the supposed pressure of earth, and therefore no current passes through the instrument. As the insulation resistance of one cable falls, the pressure between the junction and the opposite cable rises, the current it causes to pass through the measuring instrument, being a measure of the fall of resistance of the faulty cable. If the insulation resistance of both cables falls equally, the instrument does not register the fact, because the point of junction remains the hypothetical zero, but any difference in the fall of insulation of the two is registered. To meet these cases, all the apparatus on the market are provided with switches on each artificial resistance, enabling either of them to be disconnected at will. Breaking the circuit of one resistance leaves the connection between the cable it is connected to and earth still existing; and the amount, it is claimed, is read off in the deflection of the needle due to the current passing through the coil from the opposite cable.

For three-phase working, each cable has its resistance, the three being connected together at one of their ends, and through an ampere-meter to earth. As before, any fall of insulation-resistance is shown by the deflection of the needle and the fall on each cable is shown by disconnecting it from its resistance. It only requires a simple addition to the apparatus to provide for giving alarm when a certain minimum resistance from earth is reached, by ringing a bell, or lighting a lamp.

VISIT TO MESSRS. W. T. GLOVER AND CO.'S WORKS.

The members paid a visit to this Company's works on Friday last, and we illustrate on pages 652-3 some features of this Company's establishment.

The firm of Messrs. W. T. Glover and Co., Ltd., was founded in 1868 by Mr. Walter T. Glover for the purpose of covering dynamo wire with cotton, this being practically the only kind of insulated wire used in those early days of the electrical industry. The firm is now a limited company with a large capital, with works at Trafford Park, where the manufacture of all types of bare and insulated electrical cable for lighting, power, traction, colliery work, etc., is carried out, the firm also carrying out the actual fixing, laying, and all accessory work appertaining to the distribution of electricity.

Messrs. Glover have carried out during the last year or two three of the largest cable contracts ever let, involving an aggregate sum of £500,000 at Manchester Salford, and Johannesburg. In the last-named contract almost every type of cable now made was included.

[illegible] various cables for colliery and mine working on which Messrs. Glover are now specialising.

The main building consists of six large parallel bays contains large stranding machines, capable of laying up in one operation as many as sixty-one strands of wire, papering machines for putting on diatrine insulating paper, laying up machines for the purpose of cabling up several cables into one multicore cable, armouring machines, etc There were also to be noticed several very large hydraulic lead presses capable of covering cables to 4 in. in diameter, the lead being forced on while in a semi-plastic state through cores and dies.

The same main building contains the test tanks and testing machinery, capable of putting a pressure up to 72,000 volts on cables.

Another feature which the visitors inspected with no little interest was the hydraulic testing tank, patented by Mr. E. A. Claremont, the managing director This machine is designed to test the waterproofness of the lead-covered cables, pressure up to 200 lb. being applied to the cable under water.

Forcing machines for the manufacture of bitumen cables, paper serving machinery machines for covering wires and cables with rubber, a new rubber mill recently erected for the cleaning and drying of raw rubber and the mixing and preparation of the various rubber compounds used in vulcanized rubber cables. were also on view.

The whole of the machinery is electrically driven, the power being supplied by the Trafford Park Power and Light Company adjacent.

INTERNATIONAL COMMERCIAL UNION AT CONSTANTINOPLE.

A dispatch has been received at the Foreign Office, from H.M. Ambassador at Constantinople, reporting the formation of an International association entitled the "Union Permanente des Délégués du Commerce étranger," consisting of delegates from the foreign chambers of commerce in Constantinople and of delegates from those commercial communities which have no chambers of commerce.The principal object of this association is to take united action on the numerous commercial questions which arise in Turkey, and which generally affect the trade of every nation. The following questions :—1. Custom-house Analyses; 2. The prohibition of certain Trade Marks; 3. The excessive cost of Protests; which have already been deliberated upon by the Union may be noted as an example of the nature of its work.

SOCIETY OF ENGINEERS.

VISIT TO HAMPTON SEWERAGE WORKS.

A very interesting visit was made by the members of the Society of Engineers, on Wednesday, September 20th, to the Hampton Sewerage and Sewage Disposal Works.

It is about seven years since Hampton completed its main drainage works, which were carried out, departmentally, under the direction of Mr. John Kemp, the late engineer and surveyor to the Council. The contract for the machinery, cast-iron ejector chambers, air and sewage mains, was let to Messrs. Hughes and Lancaster, of London. The cost of the whole scheme was £61,915. Since 1898 sewer extensions have been necessary, owing to the development of the district, and a hydrolytic tank, on the system devised by Dr. W. Owen Travis, has been provided at the outfall works in order to deal with the crude sewage before it flows on to the contact beds. The total cost of these extensions has been about £7,000, and they have been carried out departmentally under the direction of Mr. Sidney H. Chambers, the present surveyor to the Council. The consulting engineers to the Council were Messrs. Shone and Ault, of Westminster.

A description of the original works, by Mr. Kemp, will be found in the Proceedings of the Association of Municipal and County Engineers, vol. xxvii., page 91.

The sewers and ejectors are capable of receiving and discharging the sewage of a total population of 20,000. Two 15 nominal horse-power steam air compressors are provided, each capable of dealing with the sewage of 7,500 people.

The sewage on its arrival at the disposal works is delivered into a screening chamber, where it passes through a 1½-in. mesh screen and from thence along a covered channel to the hydrolytic tank, which comprises: (*a*) Detritus chambers in duplicate; (*b*) sedimentary chambers; (*c*) liquefying chamber and sludge space; (*d*) upward filters. The sludge from the sludge space is drawn off by hydraulic head to a chamber connected to an ejector, which lifts and discharges it on the land. After passing through the hydrolytic tank the resultant effluent is conveyed to the bacteria beds. These beds are fifteen in number, built in terraces of five each.

The screening chamber was formerly open, and objectionable odours were emitted from it owing to the sewage being retained in the rising main for some considerable time. It was therefore covered in and ventilated as a part of the general ventilation of the new tank and closed channels. From the screening chamber the sewage is conveyed along a covered channel into one of two detritus tanks, which are worked alternately. Each is capable of holding the average flow of sewage during a quarter of an hour, or one-ninety-sixth of the total daily quantity. When one tank has been in work for a fortnight the sewage is diverted to the opposite tank, and the accumulated sludge is removed from the full tank by means of a valved opening, which allows it to pass into the sludge manhole and through it into the ejector, which sends it into the trenches in the land.

The sewage leaving the detritus tanks enters the centre of a transverse channel, which conveys it into the sedimentary chambers of the hydrolytic tank, which consists of two parts. The first portion is divided into three compartments, by means of light division walls formed of flagstones. Of these compartments the two outer are the sedimentary chambers and the central the liquefying chamber. Along the bottom of the sedimentary chambers are narrow openings which lead into the liquefying chamber, and form the only means of liquid communication between these chambers.

The whole volume of sewage enters the sedimentary chambers, but only seven-eighths leaves them over the weirs; the remaining one-eighth (12·5 per cent.), with practically all the depositing matters, leaves the chambers through the openings in the bottom and passes into the liquefying chamber. The floating solids are retained for a period, and are then removed through the detritus tanks. The capacity of these chambers is such that a unit volume of seven-eighths of the sewage takes five hours to pass through them. The liquefying chamber has a capacity which allows a unit volume of one-eighth of the sewage to pass through it and over its weir in fifteen hours. The greater length of time allows of the deposition of the suspended matters which accumulate in the sludge space. This space is that part of the tank below the lower margins of the openings in the sedimentary chamber; it forms a half-circle below the liquefying chamber. When the sludge approaches the upper boundary of the space a portion is removed by opening one or more of the valves, and is thrown by the ejector into the trenches.

The sewage flowing over the weirs of the first portion enters a channel which leads to the second portion of the tank. This consists of our hydrolysing chambers arranged in sequence. The liquid is conducted to the bottom of each chamber by means of nine 6-in. stoneware pipes, where it is delivered below three arches. The arches support the material, and are constructed of bricks, arranged so as to leave 2¼-in. openings between them for the passage of the sewage. The floor under each arch is concave, and forms with the arch a space for the accumulation of sludge. Under each concave floor a line of pipes having two valved openings, is laid, by means of which the deposit is removed. The material consists of broken flint stone, varying in size from 3 in. to 6 in. The liquid passes upwards through the openings between the bricks and through the material to the surface, where it overflows a wall and enters the downward stoneware pipes of the next chamber. After this operation has been repeated in the four chambers, the liquid, having taken three hours in its passage, enters the effluent channel, which conducts it to the contact beds.

The whole of the tank is constructed in concrete, and is covered with armoured concrete. The tank is ventilated by means of a fan driven by a small vertical engine, which causes a lessened air pressure in the air duct, channels and tank, and withdraws the gases as they rise to the surface of the liquid. Atmospheric air is admitted at various regulated openings.

Since the tank has been in use the effect on the beds has been very marked. Apart from the differences associated with the sludge accumulations, the following may be noted: (1) A continuous and marked increase in the capacity of the primary beds; (2) the appearance of nitrates in the secondary beds effluent and of a green growth in the channel leading from those beds; (3) the increasing amount of nitrates as well as the diminishing quantity of nitrites in the final effluent, indicating a higher degree of purification. The average daily volume of sewage treated at the present time is over 240,000 gallons.

Motor-Cars and the Dust Nuisance.

The Automobile Club of Great Britain and Ireland are holding a further series of dust trials (weather permitting) on the 23rd of this month. The stretch of road selected is at the 31st milestone from London on the Bath road, an open piece of country a little to the west of Maidenhead. Should the weather be unfavourable on the 23rd the trials will be postponed to the 30th inst. Arrangements have also been made for the trials to be photographed, so that a permanent record may be had of the dust-raising properties of the cars engaged.

THE LABOUR MARKET IN AUGUST.

As is usual for the time of the year, Board of Trade statistics regarding employment in August showed a slight falling off as compared with July. Compared with a year ago employment has improved, a marked improvement is shown in the pig-iron, iron and steel, and tinplate industries.

COAL MINING.

Employment in coal mining in August showed some recovery as compared with July, and was the same as a year ago. The average weekly number of days worked by coal mines during the four weeks ended August 26th, 1905, was 4·76 as compared with 4·63 in the previous month, and 4·76 in August, 1904.

IRON MINING.

Employment was good, and showed a little change compared with a month ago and a year ago. At the 118 mines and open works covered by the returns received from employers, the average weekly number of days worked during the four weeks ended August 26th was 5·73, as compared with 5·72 a month ago, and 5·77* in August, 1904.

PIG-IRON INDUSTRY.

In this industry employment during August was fairly good, being better than in July and considerably better than a year ago. Returns relating to the works of 108 ironmasters showed that 326 furnaces, employing about 23,000 workpeople, were in blast at the end of August, 4 more than in July, 1905, and 27 more than in August, 1904. The returns are summarised in the following table:—

Districts.	Number of Furnaces, included in the returns, in Blast at end of			Increase (+) or Decrease (−) in Aug., 1905, as compared with	
	Aug., 1905.	July, 1905	Aug., 1904	A month ago.	A year ago.
England & Wales—					
Cleveland	84	85	77	− 1	+ 7
Cumberland & Lancs.	35	33	30	+ 2	+ 5
S. and S.W. Yorks.	16	15	13	+ 1	+ 3
Derby & Nottingham	38	37	36	+ 1	+ 2
Leicester, Lincoln, and Northampton	27	27	24		+ 3
Stafford & Worcester	33	32	28	+ 1	+ 5
S. Wales & Monmouth	15	16	15	− 1	...
Other districts ...	6	6	6		..
Returned from England & Wales	**254**	**251**	**229**	**+ 3**	**+ 25**
Returned from Scotland	**72**	**71**	**70**	**+ 1**	**+ 2**
Total furnaces included in returns	**326**	**322**	**299**	**+ 4**	**+ 27**

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* Revised figures.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

(Continued from page [illegible].)

SANTIAGO DE CUBA.

Mr. Consul Mason reports that in the province of Santiago de Cuba there are many hundreds of iron claims located.

By their location the mining claims may be divided into five general groups as follows: Claims east of Santiago de Cuba, claims west of Santiago de Cuba, claims between Santiago de Cuba and Manzanillo, claims west of Baracoa, and claims in the interior.

The first four groups are all more or less near the coast. By far the most important group at the present time is that of the mines east of Santiago de Cuba. These are located in the southern slope of the Sierra Maestra, a range of mountains parallel to the coast. They lie for the most part on the second range of foothills back from the Caribbean Sea, from 1½ to four miles inland at altitudes from 200 to 1,200 ft., and form a chain of isolated deposits from 6 to 30 miles east of Santiago Bay. The western part of this group is tributary to Santiago Bay. The Juargua Iron Company, Ltd., owns its own narrow-gauge railroad, connecting mines of this group which it operates with the bay, where it owns an iron pier used exclusively for the shipment of its ore.

Further east, the Spanish American Iron Company operates mines connected by a standard gauge railroad 4½ miles long, with narrow-gauge branches ten miles long, with the open roadstead of Daiquiri, where the Company's steel ore dock, with 3,000 tons storage capacity, is located. Still further east, in this group, are the abandoned mines of the Sigua Iron Company, formerly connected with an ore dock in Sigua Bay (open roadstead) by nine miles of standard gauge road.

There are more than 100 locations in this general group, which includes all the iron mines now being successfully operated in the island of Cuba. Except Santiago, and the open roadsteads of Daiquiri and Sigua, there are no shipping ports in the neighbourhood capable of admitting ocean steamers.

The group of claims west of Santiago de Cuba may be taken to extend for 40 miles west of that port, leaving all claims further west to the third group. These claims are also in the southern slope of the Sierra Maestra, and [illegible] except Chirivico, 40 miles west of Santiago, where the Cuban Steel Ore Company had an ore dock. This was connected with the now abandoned mines of the company by six miles of standard gauge road and several narrow-gauge lines.

THE MOA GROUP.

Of the third group the principal claims are located 75 miles west of Santiago Bay, and would require some twelve miles of road to connect them with the sea, where the loading would have to be done in an open sea (which is possible), or else 12 to 15 miles more of road would have to be built to the small harbour of Portillo. The group west of Baracoa on the north coast of the island are known as the Moa mines. They are near Moa "Bay," so called because partially protected by reefs. Depths of water for large vessels is claimed, although no large vessels have ever used the "bay." Practically no work has been done here.

The inland mines are for the present inaccessible for lack of transportation. The ore will not bear road transportation, and there are no canals. All transportation must be by rail. In estimating cost it must be borne in mind that a company operating mines must build its own railroad and dock as in the case with the four companies already cited. Cost of transportation varies with length of haul, in actual practice, from nine cents per ton over five miles of road with favourable grades to 60 cents per ton over 20 miles of line with some steep adverse grades, not including interest and depreciation.

The labour available is for the most part Spanish. The labourer from Galicia is a good pick-and-shovel man, and stands the climate well. Cubans do not take to mining work. Puerto Ricans have been tried with moderate success. Italians and negroes from Jamaica, Fortune Island and Inagua, have been tried, but are greatly inferior to the "gallego" labourer.

Wages are $1.00, American gold, per day for any labour. Most companies feed the men for 25 cents daily, but this is not obligatory to the men.

All mines are on side hills, and the work is quarrying rather than mining. Cost of mining varies with the amount of waste it is necessary to handle. All of the [illegible] [illegible] easily waste [illegible] is necessary to handle from one to four cubic yards of waste for [illegible] yard [illegible] mined. Costs from [illegible] including labour, tools, supplies consumed, fuel, explosives, and superintendence; but not including exploration or new constructions. To this must be added railroad freight and cost of shipping, which, with a [illegible] constructed dock, will be less than [illegible] cents per ton.

ANALYSIS OF THE ORE.

The following is an average analysis of nearly 500,000 tons produced in one group of mines in 1902: Iron [illegible]; silica [illegible]; phosphorus [illegible]; sulphur [illegible]; moisture [illegible].

Ore of similar quality is found in some of the other groups. The bulk of the samples analysed thus far from the Moa group run 40 to 50 per cent. in iron. From the most easterly mines, east of Santiago, the ore average is 55 to 58 per cent. iron. Phosphorus is generally low, most of the ores being well within Bessemer limits. Sulphur occurs chiefly as pyrite in bunches, and in some places is absent altogether.

Except the companies mentioned, proprietors are generally poor, but have exorbitant ideas of the value of their claims. They are ready to sell, but have not explored their claims, and cannot show ore commensurate with prices asked.

Deposits have been worked as follows: Shipments of iron ore during the calendar year, 1902: By the Juragua Iron Company, Ltd., 221,039 tons; by the Spanish American Iron Company, 445,105 tons; by the Cuban Steel Ore Company, 33,590 tons: total, 699,734 tons.

Total shipments by the several mining companies from time of first opening their mines down to close of year 1902 have been: by the Juragua Iron Company, Ltd., 3,911,795 tons; by the Sigua Iron Company, 20,438 tons; by the Spanish American Iron Company, 1,777,118 tons; by the Cuban Steel Ore Company, 41,241 tons; total, 5,750,592 tons.

There are no special obstacles to continuous and unencumbered mining, except the fact that the work, being carried on in the open air, is somewhat delayed in times of heavy rains.

The Spanish Government made special concessions to encourage mining, till now that industry is practically free from all taxes. No export tax has ever been paid, and import taxes on materials have been light, and at times nil. Nor has the man who located the mine had to pay anything beyond a moderate fee for measuring and registering, and once [illegible] mineral tax, however long the mine might remain in his possession without working it.

HONDURAS—TEGUCIGALPA.

Mr. Consul Campbell states that there are various deposits of iron ore reported to exist in the department of Colon, between the department of Olancho and the Caribbean Sea, and near Catacamas in the department of Olancho; more than a hundred miles from Trujillo, but near Patuca River, which may be made navigable at some early date.

Other deposits are near Concordia and Boquin in the same department of Olancho; nearest port, Trujillo; and at Agalteca, twelve leagues north of Tegucigalpa; near Minas de Oro, perhaps 130 miles from Puerto Cortes; and near Lake Yojoa, which is situated not far from the projected Inter-oceanic Railway, and about sixty miles from Puerto Cortes.

Except for fifty-seven miles of railway inland from Puerto Cortes on the north coast, all transportation is made on mule back, or in case of very heavy loads, and in places where the roads allow it, by means of ox-carts. Under the most favourable circumstances as to roads, weather, and supply of mules, etc., the price per ton of 2,000 lb. could not be less than £4, and with unfavourable circumstances could easily be double that amount.

Roughly speaking, unskilled labourers receive at least 2s. per day. The estimate of cost of mining, etc., is quite out of reach. The only analysis obtainable is given below. The proprietors of the most important deposits, those of Agalteca, are the Government, and it is understood that they are prepared to let all or part of it for very long leases against a royalty of 5 per cent. of the product. Probably the other deposits belong to private persons, who would not be likely to ask very high terms.

The quality of the ore may be judged by the following comparison with the Cuban ores, based on an analysis of both made in the laboratories of Birmingham and Bessemer, Alabama, United States of America, during the years 1896–7.

AGALTECA:—	
Metallic iron	68 to 71 per cent.
Sulphur	Trace.
Phosphorus	0·002 per cent.
Titanic acid	None.
CUBA:—	
Metallic iron	62 to 65 per cent.
Sulphur	[illegible] per cent.
Phosphorus	0·026

The difficulty of utilising all the products of this country lies in the lack of adequate means of transportation, but several of the districts mentioned have projected railway lines within a reasonable distance.

(*To be continued.*)

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Burton-upon-Trent.—Supplying and laying of feeder cables, conduits and other works in connection therewith, for the Burton-upon-Trent Corporation. Messrs. Kincaid, Waller, Manville, and Dawson, 29, Great George Street, Westminster, or Tramway Engineer's Office, Guild Street, Burton-upon-Trent ... . Sept. 25

Kettering.—Supplying electrically-driven centrifugal pumps, to deliver 30,000 and 40,000 gallons per hour against a head of about 30 ft. for the Urban District Council. Mr. Thos. R. Smith, engineer and surveyor, Market Place, Kettering. Sept. 26

Uxbridge.—For supplying and erecting a circular steel tank of 100,000 gallons capacity, together with all pipe connections thereto; also the supplying and laying of 2,370 yards of 6 in. cast-iron pumping and service main, with connections, &c., for the Uxbridge Urban District Council. Mr. F. S. Courtney, M.Inst.C.E., 25, Victoria Street, Westminster, S.W. . .. Sept. 27

London.—Supply and delivery of (a) 34 steel single-deck tramcar bodies; (b) maximum traction swing bolster trucks for 34 electric cars; (c) complete electrical equipments for 34 cars, or alternatively, (d) 34 steel single-deck cars, with trucks and equipments complete, for the London County Conncil, County Hall, Spring-gardens, S.W. ... . Sept. 29

Pontypridd.—For the Pontypridd Urban District Council: (Section B) overhead equipment for tramways, (C) cables for ditto. Mr. Reginald P. Wilson, 66, Victoria Street, Westminster ... ... Sept. 30

Southgate.—Work and materials required in the construction of the permanent way (for electric traction), bridge work, road widenings, etc., for Contract No. 14; railway No. 2 to be laid along Bounds-Green Road, Wood Green, and High Road, Southgate, for the Light Railways and Tramways Committee of the Middlesex County Council. Mr. H. T. Wakelaw, Middlesex Guildhall, Westminster, S.W. ... .. Oct. 2

Westerham (Kent).—Providing and fixing a steam engine with lift and force pumps (capable of delivering 500,000 gallons of water in 24 hours) on land at the Hill Park Estate, Westerham, Kent, for the Metropolitan Water Board. District Engineer, Brookmill-road, Deptford, S.E. ... ... Oct. 2

Last Day.

London.—Boilers and boiler-house plant, new laundry machinery, and revisions to laundry plant, also new steam main, etc., at the Eastern Hospital, Homerton, N.E., for the Metropolitan Asylums Board. Offices of the Board, Embankment, E.C. Oct. 3

Watford.—Drainage and sewerage works at Cassio Bridge, for the Watford Urban District Council. Mr. David Waterhouse, Surveyor to the Council, Watford ... Oct. 4

Lanark.—Supplying and laying, within the Lesmahagow special water supply district about nine miles of cast iron pipes, varying from 1½ in. to 5 in. in diameter with other relative work, for the Upper Ward, District Committee of the County Council of Lanark. Messrs. Warren and Stuart, civil engineer, 94, Hope Street, Glasgow. Oct. 7

London.—Works in connection with the partial reconstruction of bridges carrying Clerkenwell Road over Metropolitan Railway; Commercial Street East, over Great Eastern Railway; East India Dock Road over North London Railway; and High Street, Kingsland, over North London Railway (docks line); and the reconstruction of bridge carrying Denmark Hill over the London, Brighton, and South Coast Railway for the London County Council. Mr. Maurice Fitzmaurice, Spring Gardens, S.W. ... ... Oct. 10

COMING CONTRACTS.

Dewsbury.—Sanction has been received by the Council to a loan of £9,762 for extensions of the electricity works.

Bradford.—The Corporation are applying for a loan of £30,079 for constructing the Wyke tramways. The Tramways Committee have prepared a scheme for giving tramway connection between Bradford and the Spen Valley.

Aldershot.—An inquiry has been held into the application of the Council for permission to borrow £2,000 for electric lighting extensions.

Great Grimsby.—The Council have applied for a loan of £18,000 for extending the electricity works.

Pembroke (Dublin).—The District Council have decided to carry out extensions of their electric lighting undertaking at an estimated cost of between £20,000 and £25,000.

Colchester.—The borough engineer and the borough electrical engineer are preparing plans for the Military Road extension of the tramways; in order to carry out which the Local Government Board will be asked to sanction a loan of £7,334.

CONTRACTS CLOSED.

Salford.—The Town Council on September 6th accepted the following tenders: Ferranti, Ltd., house meters; Key Engineering Company, Ltd., motor starters; Sperryn and Co., Ltd., tumbler and link switches; St. Helen's Cable Company, Ltd., workshop flexible cables; Lancashire Dynamo and Motor Company, Ltd., electric motors; British Westinghouse Electric and Manufacturing Company, Ltd., feeder boosters.

South Shields.—The tender of Messrs. Arnold and Son, of Doncaster, for the erection of the carsheds, in connection with the Corporation tramway system, the amount being £9,425, has been accepted.

Southport.—The tender of the British Insulated and Helsby Cable Company, Ltd., has been accepted for the supply of switch pillars, one at £17 10s. and four at £25 5s. 7d.

Stalybridge.—The Electricity and Tramway Board has accepted the tender of the British Westinghouse Company for the supply of an additional machine for the Stalybridge substation.

Hartlepool.—Messrs. Richardson, Westgarth and Co., Ltd., of Hartlepool, have secured an order through their Glasgow agents, Messrs. A. R. Brown, McFarlane and Co., Ltd., for three natural draught chimney type cooling towers for a total capacity of 255,000 gallons per hour, to be erected in the new works of the Kosmoid Tube Company, Ltd., at Dumbarton. They are also supplying another tower to deal with 50,000 gallons per hour to the Scottish House to House Electricity Company, Coatbridge. These towers will be fitted with the makers' new patented machine moulded splash bars.

Honley.—Mr. M. K. North, M.Inst.C.E., has conducted a Local Government Board inquiry into the subject matter of an application of the Honley Urban District Council for approval to the borrowing of £8,000 for purposes of their gas undertaking.

Liverpool.—Messrs. D. Rollo and Sons, of the Fulton Engine Works Liverpool, have secured the contract for the engines of two new steamers for the Wallasey Ferries.

Dartford.—Messrs. Babcock and Wilcox have received an order from the District Council for the supply of a Baker oil separator for their electricity works.

Brighton.—The tender of the Transporter Company, Ltd., for a coal-handling equipment for the Southwick power station has been accepted at £2,321.

Derby.—Messrs. S. Dixon and Son, Ltd., have received an order from the Corporation for one Turner's patent automatic point controller as sample.

Barrow.—Sir William Arrol and Co., have secured the contract for the construction of a bridge across the Watney Channel, between Barrow-in-Furness and Vickerstown.

New Zealand.—The New Zealand Government have just placed an order for a large coal briquette-making plant with Wm. Johnson and Sons (Leeds), Ltd., Armley, Leeds), the output from which will be about 200 tons per day of eight hours. This is similar machinery to that which the firm named have shipped a large quantity of to the United States.

London.—Messrs. Wm. Denny and Brothers, Dumbarton, have received an order from the General Steam Navigation Company, (Ltd.), for the construction of a new turbine passenger steamer, to steam at 21 knots, for the service from Tilbury to Margate and Boulogne.

APPOINTMENTS VACANT.

Battersea.—The Governing Body of Battersea (London) Polytechnic invite applications from electrical engineers with teaching experience for evening lectureship in electrical engineering. Mr. Joseph Harwood, secretary... ... ... —

Bristol.—An assistant lecturer and demonstrator in engineering is required at the Merchant Venturers' Technical College, Bristol. Salary £170. Particulars from Registrar ... . —

Wellington (New Zealand).—Wellington (New Zealand) Technical Education Board require an instructor in engineering. Salary £300, with £40 passage allowance. High Commissioner for New Zealand, 13, VictoriaStreet, London, S.W.

APPOINTMENTS FILLED.

Midland Railway.—The locomotive works manager of the Midland Railway at Derby, Mr. Cecil W. Paget, will, in consequence of recent retirements, after November 1st next, act as chief assistant to the locomotive superintendent, in addition to his present duty as works manager.

Halifax.—Mr. J. C. Couper, of Newcastle-on-Tyne, has been appointed tramways traffic superintendent at Halifax.

Cardiff.—Mr. W. J. R. Thomas, of London, has been appointed assistant electrical clerk of works for the Cardiff Asylum at Whitchurch.

Smethwick.—Mr. A. W. Allen, B.A., has been appointed teacher of theoretical magnetism and electricity, and Mr. A. Adams, F.I.C., teacher of practical magnetism and electricity, at Smethwick Municipal Technical School.

Leeds.—Mr. Richard Chamberlain, of Corbridge-on-Tyne, was on Wednesday appointed by the Leeds Waterworks Committee to fill the position of resident engineer at the Kettlesing Tunnel works, in connection with the Leeds water supply.

Glasgow.—Mr. Alexander Lawson Mellanby, D.Sc., Lecturer in Engineering at the Manchester School of Technology, has, we understand, been appointed to the Chair of Engineering in the Glasgow and West of Scotland Technical College.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols: Oct. 4th. General Settlements September 28th, October 13th, 27th. Bank Rate, September 7th, 1905, 3 per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
11,270	5	5	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¼— 2¾
10,000	5	9/-	Do. Cum. Pref. 6 per cent.	5	4½ - 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 1/16 3 5/16
76,970	5	2/-	Do. 4% Cum. Pref.	5	5¼— 5¾
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102½—104½
£100,000	100	4½%	Aveling and Porter, Ltd., 4½%, Reg Mt Debs. Red.	100	96 — 99
530,000	1	2/4	Babcock and Wilcox, Ltd., Ord.	1	3½- 3¾
100,000	1	7½d.	Do. „ 6% Cum. Pref.	1	1 1/16 — 1 3/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾— 5¼
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	2/3	Barrow Hæmatite Steel Co., Ld., O	4½	1¼— 1⅜
50,000	4½	3	Do. do. Cum 2nd. Pref.	4½	4½— 4¾
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	4½	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104½—106½
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾— 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100--102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	5/16—7/16
300,000	1	6½d.	Do. 5½% Cum Pref.	1	11/16 - 13/16
£300,000	Stk	4½	Do. 4½% Red. Deb. Stock	100	93 — 96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 — 1⅛*
1,860,900	1	3d.	Do. Nos. 1,639,101-2,500,000	12/-	[illegible] — [illegible]
1,160.000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1¼— 1⅜
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1 1/16— 1 3/16
74,000	10	5%	Do. 5% Cum. Pref.	10	11⅛—11⅜
154,500	5	[illegible]	Cammell, Laird & Co., Ltd., Ord.	5	9⅞—10⅛
232,500	5	2/6	Do. 5% Cum. Pref.	5	5 9/16 - 5 13/16
450,000	1	1/2	Clayton & Shuttleworth, Ltd., Ord.	1	⅞ - 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼— 5½
£250,000	Stk	4	Do 4% 1st Mort Db. Stk Red	100	100 -102
100,000	10	30	Consett Iron Co., Ltd., Ord.	7½	32½ 33½
57 031	10	10/-	Crossley, Bros., Ld., Ord 40340/97370	10	15 1/16 15½
40,339	10	[illegible]	Do 5% Cum Pref	10	11 — 11½
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 - 2¼
1,259,594	1	3d.	Dorman, Long & Co., Ltd.	1	⅝ 11/16
£400,000	Stk	4	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 - 94
200,000	5	3/	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3¼ 3¾
250,000	1	9d.	Dunlop (James) & Co., Ltd., Ord.	1	[illegible] - [illegible]
300,000	1	7d.	Do. 6% Cum. Pref.	1	⅞ - 1
4,721	13	13	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ 9½
69,754	13	10/-	Do. do. do.	10	6¼ 7¼
20 250	10	[illegible]	Elliott's Metal, Ltd.	8	5¼ - 5¾
5,000	10		Do. Cum Pref. 5%	10	8¾ 9¼
186,748	Stk	4	Do. Deb 4%	100	90 94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11 — 11½
£250,000	Stk	4½	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	[illegible]	Fleming & Ferguson, Ltd Ord Nos 1/9000	10½	12¼ 12¾
6,000	10		Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10½
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	3¾ 4¼
21,000	3	1/-	Do. 7½% Cum. Pref.	3	5½ 6
10 000	10		Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6½ 7½
£150,000	Stk	4	Do 4% 1st Mort Deb Red	100	88½ 89½
16,800	10	10	Greenwood & Batley, Ltd., Ord.	10	6½ 7½
9,000	10	7	Do. 7% Cum. Pref.	10	10 10
965,000	1		Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 2[illegible]*
314,000	5	2/	Do. 5% Cum. Pref.	5	6¼ 6½
£1,850,500	Stk	4	Do. 4% Irred. Mort. Deb. Stk	100	105 107
13,000	5	[illegible]	Gwynnes, Ltd., [illegible]	5	2 — 3
250,000	1	1	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅝ 3¾
20,000	10	4½	Do. 4½% Cum. Pref.	10	10½— 11
30,000	5		Hall (J. & E.), Ltd. 6% Cum. Pref.		5½
405,502	1	1/6	Harvey United Steel Co., Ltd.	1	1
47,500	10	5/-	Hawthorn, Leslie & Co., Ltd. Ord.	10	[illegible]
28,001	5	7	Head, Wrightson & Co., Ltd.	5	5 — 5¼
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	[illegible]
18,000	[illegible]		Do. [illegible] Cum. Pref.		1 [illegible]
£100,000	Stk	[illegible]	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
750,000	1	7½%	Howard & Bullough, Ltd., Ord.	1	1 1/16 1 3/16
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	12½ 13
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95 - 98
37,500	10	20	Kynoch, Ltd	10	17 —17½
49,537	10	5%	Do. Cum. Pref. 5%	10	10¼—10¾
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝— ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 4¼
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	[illegible] [illegible]
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 1/16 1 3/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼ 11¾
210,000	1	8½d.	Measures Bros., Ltd., Ord.	1	½ ¾
75,000	1	6½d.	Do. 5½ Cum. Pref.	1	¾ ⅞
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	93 96
21,943	5	2/6	Muntz Metal, Ltd.	5	4½— 5
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 —12½*
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88 91
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	4¾ 5¼
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	6¼ - 6¾
70,000	10	10/	Pease & Partners, Ltd., Ord.	10	10¼—10¾
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	100—103
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	4⅞— 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 6/6
13,000	5		Do 5½% Cum Pref.	5	4⅜— 4⅝
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅜ 1⅝
73,062	5	2/-	Do. New	5	1¼ 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	99 101
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000	1	[illegible] — [illegible]
£350,000	1	7½	Do. 6% Cum. Pref.	1	1 - 1⅛
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	95 — 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	10 —10½
275 000	1	6d.	Scott (Walter) Ltd., Ord	1	11/16 13/16
300,000	1	7½d.	Do. 6% Cum. Pref.	1	⅞ 1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	93 - 95
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red	100	93 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	95 99
250 000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	¼ ½
300,000	1	1/2⅔	Do. 6% Cum. Pref.	1	¼ — ½
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	92 — 95
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560	9	7 — 7½
£125,240	Stk	5%	Do 5% Trust Mort. Deb	100	103 106
25,000	10		Stephenson (Robert) & Co., Ltd., Or.	10	1½ 2½
25,000	10	5/6	Do. 5½% Cum. Pref.	10	3½ 4½
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	77 80
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	18½ 19
55,000	10	6/	Do. 6% Cum. Pref	10	14¼ 14¾*
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ — ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	1 — 1 1/16
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co. Ltd. 5% Cum. Pf.	1	[illegible] [illegible]
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80 83
£118,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	[illegible]
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	[illegible] 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼ 9¾
$508495200	$100	$4	United States Steel Corp. Com. Stk.	$100	37½ 37¾
$360311100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	107¼ 107¾
$162268000	$1000	[illegible]	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	100 - 102
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord.	1	2 2⅛
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1 1/16— 1 3/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	120 123
£1,250,000	Stk	4	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½	Do. 4½% 2nd Mort. Debs., Red.	100	105 —107
225,000	1	[illegible]	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	[illegible]
500,000	1	7½	Do. 6% Cum. Pref. Ord.	1	[illegible]
£300,000	Stk	4	Do. 4% Perpetual Deb. Stock	100	[illegible]
7,037	5		Weldless Steel Tube, Ltd., Cum. Pref.		4½ [illegible]
300	Stk	4½	Do. Mort. Deb. 4½%	100	[illegible]
66,666	5	3	Willans & Robinson, Ord.	5	[illegible]
66,666	[illegible]		Do. [illegible] Cum. Pref.		[illegible]
£246,641	Stk	4	Do. 4% 1st Mort. Deb. Stk. Red	100	7[illegible] [illegible]
£150,000	Stk	4½	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	[illegible] [illegible]

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	[illegible]
[illegible]	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	[illegible]
120,000	1	[illegible]	Bell's Asbestos Co., Ltd.	1	1[illegible]—1
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¾—6¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½—6¼
£500,000	Stk	4½	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103—106
£200,000	Stk	4½	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99—101
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2½—[illegible]
£616,353	Stk	4	Do. 4% Mort. Deb Stk. Red...	100	[illegible]—89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	[illegible]
150,000	2	2/4½	Do. 6% Pref.	2	1¼—1[illegible]
£125,000	Stk	4½%	Do. 4½% Perp 1st Deb. Stk...	100	91—94
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	78—81
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10—11
40,000	5	2/6	Do. 5% Cum. Pref. ..	5	5½—5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	109—111
85,000	3	1/6	Crompton & Co., Ltd...	3	1[illegible]—1⅞
£100,000	-	5	Do. 5% 1st Mort. Reg. Debs.	100	95—100%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾—8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	6—6¼
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105—107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛—1¼
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106—109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1½—1⅝
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2—2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. .	100	83—88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89—94
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	[illegible]—1
31,390	2	2/9	Do. 7% Cumulative Pref. ..	2	1¾—2¼
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92—95
10,248	10	7/6	Evered end Co., Ltd...	10	10—12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90—95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9¾—10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12—13
35,000	5	2/3	Do. 4½% Cum. Pref. ..	5	5¼—5½
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111*
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½—16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100—103
7,500	10		Parker, Thos. Ltd.	10	6¾—7
100,000	1	3d.	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	33½—35½
£150,000	100	4%	Do. 4% Deb. Bonds	100	102—104

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
120,000	5	[illegible]	Anglo-Argentine Trams Co., Ld., Or.	5	[illegible]
260,007	5	[illegible]	Do. 5% Cum. Pf.	5	[illegible]
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141—144
20,000	10	[illegible]	Barcelona Trams Co., Ltd., Ord. ..	10	[illegible]
10,000	10	5/-	Do. [illegible] Cum Pf. Shares	10	9½—10
£[illegible]	100		Do. 5% Debs., Red. ..	100	[illegible]—101
£[illegible]	Stk	4½	Do. 4½% Red. Deb. Stk.	100	[illegible]—102
75,606	1		Bath Elec. Trams. Ld., Pf. Or. ..	1	[illegible]
[illegible]	1	[illegible]	Do. 5% Cum. Pf. ..	1	[illegible]
75,000	5		Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1—1½
75,000	[illegible]	[illegible]	Do. [illegible] Cum. Pf.	5	[illegible]
£[illegible]	[illegible]	[illegible]	Do. 4½% 1st Deb. Stk., Red.	100	[illegible]
£200,000	Stk	[illegible]	Brit. Columbia Elec. Rly. Co., Ltd., [illegible] .. .	100	119—122
		[illegible]	Pref. Ord. Stock	100	104—107
133,301	10	[illegible]	Brit. Electric Traction, Ltd., Ord.	10	[illegible]
[illegible]	10	[illegible]	Do. 6% Cum. Pref.	10	10—11
£[illegible]	Stk	[illegible]	Do. 5% Perp. Deb. Stk. ..	100	[illegible]
£[illegible]	[illegible]	4%	Do. 4% 2nd Deb. Stk. Red..	100	99—101
[illegible]	5	2/6	[illegible] Electric Trams, Ltd., Ord.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible] Cum Pref.	[illegible]	[illegible]
27,000	[illegible]	3/-	[illegible]	[illegible]	[illegible]

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97—99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103—107
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9½—10
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107—109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1[illegible]—1⅛
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4¾—5¼
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	109—1[illegible]
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103—105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½—14½
59,987	10	6/-	Do. 6% Pref...	10	15—16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¼—2¾
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	[illegible]3—[illegible]
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref. .. .	10	[illegible]—10¼
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99—102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	103—105
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	[illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	[illegible]—1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105—107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	[illegible]—1½
110,923	8	2/9	North Metropolitan Tramways Co..	8	4½—4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93—98
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	104—107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾—9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9—9[illegible]
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101—104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11½—12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½—10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11—12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106—108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	[illegible]
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	104—107
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. .	5	9¾—10¼
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9⅝—10⅛
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9¼—9¾
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103—106
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	[illegible]—7¼
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½—[illegible]
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103—105
41,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	[illegible]
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108—110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11—11¼
40,000	10	6/-	Do. 6% Cum. Pref.	10	13—14
£100,000	Stk	5%	Do. 5% Deb. Stk., Red .	100	124—12[illegible]
£300,000	Stk	4½	Do. 4½% 2nd Deb. Stk., Red	100	104—106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	[illegible]—9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	[illegible]—12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111—114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	[illegible]
70,000	5	3/-	Do. 6% Cum. Pref.	5	[illegible]
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Red	100	106—108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	[illegible]—90
19,000	5	6/-	Folkestone Elec. Supply Co., Ld., O.	5	[illegible]
£50,000	Stk.	4½	Do. 4½% 1st Deb. Stk., Red.	100	99—102
15,000	10		Havana Electricity Co., Ltd... ..	10	9¾—10½
13,000	[illegible]	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	[illegible]
£50,000	Stk	4½%	[illegible] Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1		Kalgoorlie Electric Power & Lighting Corp., Ltd., 6% Cum. Pref.	1	[illegible]
21,000	5	[illegible]	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. .	[illegible]	12—1[illegible]

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4 %	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9	London Elec. Supply Corp., Ltd., Ord.	3	2 — 2¼
60,000	5	3/-	Do. 6% Pref.	5	[illegible]
£371,895	Stk	4 %	Do. 4% 1st Mort. Deb Stk. Red	100	99 -102
100,000	10	[illegible]	Metropolitan Elec. Sup. Co., Ld., Or.	10	10[illegible] 11¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5[illegible]— 5¾
220,000	Stk	4½	Do. 4½ 1st Mort. Db. Sk. Red	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red	100	100 —102
£250,000		4½%	Midland Elec. Corp. for Power Distribution Ltd., 4½% 1st Mort. Deb.	100	100—102%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 102
16,500	5	2/6	Oxford Electric Co. Ltd., Ord.	5	6½ 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99 —101
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13[illegible] 14[illegible]
20,000	5	3/6	Do. 7% Pref.	5	[illegible]
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¼ - 2[illegible]
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 80
65,000		4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1		South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	[illegible]
50,000	1	8½d.	Do. 7% Cum. Pref.	1	1[illegible] 1
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4¾— 5
30,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk Red	100	105—107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12¾ -13¼
28,151	5	2/6	Do. 5% Cum. Pref. ..	5	6¼ —6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£34,800	100	4 %	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red. ..	100	99 102
25,000	10		Amazon Telegraph Co., Ld... ..	10	3 - 3½
£763,580	Stk	14/-	Anglo-American Tel. Co., Ltd., Ord.	100	61 — 63
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	107¼ 108½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	16[illegible] 17
44,000	5	5	Chili Telephone Co., Ltd.	5	7½ 7[illegible]
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	—
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	9 - 9½
6,000	10	10/-	Do. 10% Preference ..	10	17½—18½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3¼ - 3¾
		[illegible]	10% Cum. Preference	5	9¼ — 9[illegible]
£30,000	50	4½	Do. 4½% Debs.	50	100-102
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11¾ 12¼
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99 101½
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101 103½
900,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾—14¼
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 - 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord.	100	144½ 147½
£2,000,000	Stk	17/6	Do. 3½% Pref. ..	100	90 —92
£1,846,814	Stk	4	Do. 4% Mort. Deb.	100	108 110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	34½—35½
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd.	25	[illegible] 54½
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	[illegible]— ⅞
£1,983,333	Stk	[illegible]	National Telephone Co., Ltd., Pref.	100	111½—112½
£1,966,667	Stk	[illegible]	Do. Deferred	100	107½—109½
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	[illegible]
£2,000,000	Stk	[illegible]	Do. 3½% Deb. Stk., Red. ..	100	[illegible] 101½
[illegible]	Stk	4	Do. 4% do.	100	104—106
179,313	1	8½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 [illegible]
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 1[illegible]
£100,000	100	4	Pacific & European Tel. 4% Guar. Debs. Red...	100	101 103
11,850	8	1/-	Reuter's Telegram Co., Ltd.	8	8 - 8½
[illegible]	5	3	United River Plate Telep. Co., Ltd.	5	7 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5¼— 5½
£179,947	Stk	[illegible]	Do. 5% Deb. Stock, Red. ..	100	109 111
[illegible]	10		W. African Telegraph Co., Ltd. ..	10	10—10½
[illegible]	25		West Coast of America, Ltd.	[illegible]	[illegible]
150,000	100	4	Do. 4% Deb. [illegible]	100	[illegible] 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	[illegible]
34,563	10	6/-	Do. 6% Cum. 1st. Pref.	10	[illegible]
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	7 — 7½
£80,000	100	5%	Do. 5% Deb. ..	100	101 —104
207,930	10	3/-	Western Telegraph Co., Ltd.	10	14 14½
£7[illegible],000	100	5	Do. 5% Debs., 2nd Series, 1906	100	101 103
518,945	Stk	4%	Do. 4% Deb. Stock, Red.	100	102½ 104½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9 - 9½
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	101—103
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	96 - 98
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	[illegible] - 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11[illegible] 1[illegible]
40,000	20	8/	Do. Nos. 60,001-100,000	10	4¾ - 5¼
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	103 105
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1¼ 1[illegible]
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	[illegible] - 5¼
36,758	8	4/9½	Do. Non Cum. 6% Pref. ..	8	8 - 8¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼ - 2[illegible]
40,000	5	2/9	Do. 5½% Cum. Pref. ..	5	2¾ - 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 - 88
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	7 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	129 —132
£1,160,000	Stk	19%	Do. do Deferred ..	100	228 —231
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	35 — 36
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾ - 5¼
39,075	5	2/6	Do. "B" Ord...	5	[illegible] 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8[illegible] 8[illegible]
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10½ 11
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
60,000	1	9d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 1[illegible]
£750,000	Stk	[illegible]	General Hydraulic Power Co., Ltd.	100	123 128
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 - 25
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. [illegible] ..	15/-	¼ [illegible]
66,462	1	8·4d.	Do. do. Nos. 1-66,462	1	[illegible] ¾
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ 1¼
135,000	1	7½d.	Do. 6% Cum. Pref.	1	1[illegible] 1[illegible]

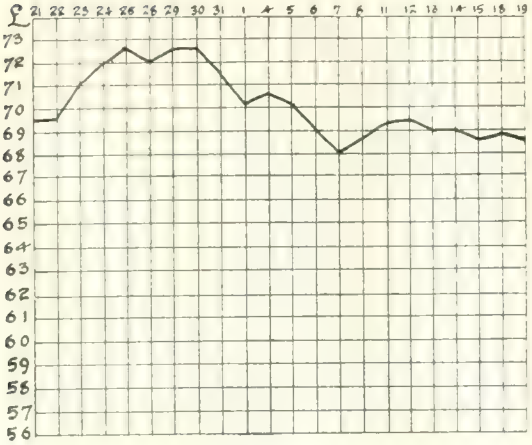
RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
10,000	10	7/6	[illegible] Car. & Wagon, L., 1-10,000	10	[illegible]
8,739	10	[illegible]	Do. Second Issue 1-8,739....	4	[illegible]
10,000	10	[illegible]	Do. Cum. Pref. 6% 1-10,000..	10	1[illegible] —14
30,111	7	7[illegible]	Gloucester Rail.-Car & Wagon, Ld., A, 1-[illegible]	7	[illegible] — 10
44,889	7	[illegible]	[illegible]	7	4 - 4[illegible]
14,567	10	1/3	[illegible] Wagon, Ord.	[illegible]	2[illegible]
4,150	10	[illegible]	[illegible]	10	[illegible] 10¼
784,808	1	[illegible]	[illegible] Amalgamated Rail. Carriage & Wagon, Ld., 1-784,808	1	42/6—[illegible]
164,288	1	[illegible]	Do. Cum. A Pref. [illegible] 1-164,288	1	[illegible]
235,000	1	[illegible]	Do. Cum. B Pref. [illegible] 1-235,000	1	[illegible] 29/
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	1[illegible]	18 —19[illegible]

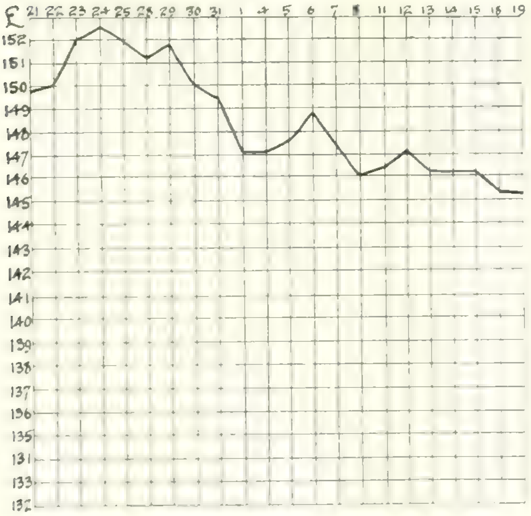
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM AUGUST 21st TO SEPTEMBER 19th, 1905.

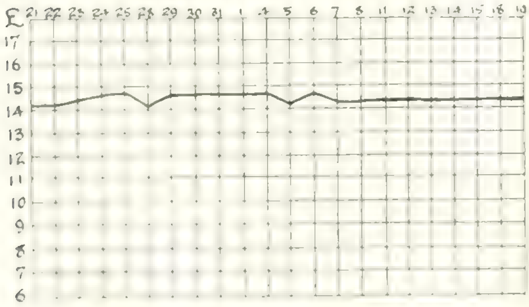
COPPER.



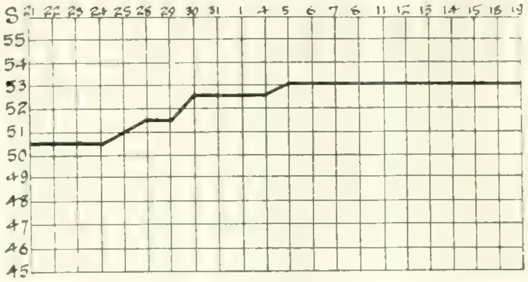
TIN.



ENGLISH LEAD.



PIG IRON: SCOTCH,



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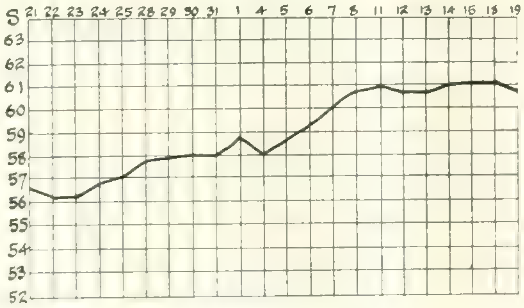
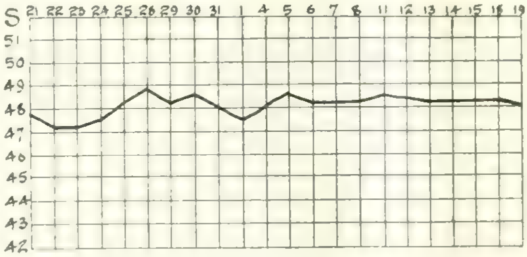
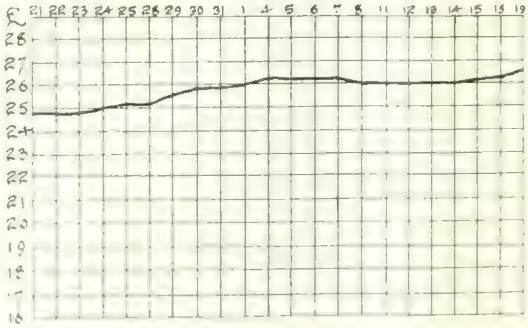


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, September 20th, 1905.

THE demand for Copper has been quiet, and the lack of confidence thus indicated has been reflected in quotations, values receding to £68 7s. 6d., although at one time on bear covering the quotation rose to £69 15s. The close yesterday was steady at £68 15s. Messrs. Merton and Co's statistics give the visible supply as 15,875 tons against 17,620 tons a fortnight ago.

The Tin market has been rather more active, and on speculative operations heavy fluctuations have been recorded. At first on heavy bear repurchases the quotation rose until £147 7s. 6d. was reached for cash, but later in the week the market was again subjected to depressing sales for forward delivery. The large amount of metal offered was, however, fairly well absorbed, and this imparted renewed steadiness to the market. The forthcoming Banca sale is not without its influence, and the wire pullers are endeavouring to keep the market at a low level pending the auction. It is understood that American stocks have now reached a very low level, and the near future is likely to witness exports to the United States. The closing quotations yesterday were £145 10s. cash and £144 10s. three months.

The Lead market remains depressed, the only feature being some demand for prompt delivery which has had a slight steadying effect. Soft foreign prompt is quoted £13 17s. 6d., and English £14 0s. 0d.

After a temporary cessation of buying, the Spelter market has again entered upon a firm phase and buyers are prepared to pay higher prices. Supplies appear to be growing restricted and the trend is for a further rise in quotations. Ordinaries are quoted at £26 2s. 6d., and Specials at £26 12s. 6d.

In the Iron and Steel section the reports from trading centres are extremely satisfactory. A healthy tone prevails in the majority of the manufacturing trades, works are mostly in active operation, and prices have been advanced. Pig iron makers appear to be well satisfied with the outlook, many of them having sold their output well ahead. Reports from America indicate a prosperous condition of the American steel trade. The latest quotations for Cleveland is 48s. 2d.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	7	5	0
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	15	0
STEEL	,, ,, Angles ...	5	15	0

Manufactured Iron:

	£	s.	d.
Bars—Dalzell	6	5	0
,, Best	6	15	0
,, ,, Horseshoe	6	15	0
,, Angle	6	5	0
,, Best Angle	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	10	0	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	10	0	,,
Glasgow ♛♛ Steel.				
Steel Bars, Boiler Quality	7	0	0	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	6	7	6
,, Best	6	17	6
,, Best Best	7	7	6
,, Extra Best	7	17	6
,, Best Horse Shoe	6	17	6
,, Extra B.H.S.	7	17	6
,, Extra Best Cable	8	7	6
,, Rivet	6	7	6
Best Scrap Rivet	7	7	6

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	—			2	14	0
Gartsherrie ,,	2	18	6	2	13	6
Summerlee ,,	2	18	0	2	13	0
Carnbroe ,,	2	15	6	2	13	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	18	6	2	13	6
Clyde ,,	2	18	6	2	12	0
Glengarnock, f.o.b. Ardrossan	2	18	0	2	13	0
Eglinton ,, ,,	2	14	6	2	12	0
Dalmellington, ,, Ayr	--			2	12	6
Shotts ,, Leith	2	18	6	2	14	0

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♛ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♛	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♛ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote :—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♛	Flat	6	15	0	7	0	0
	Angle	7	5	0	7	10	0
(BNF)	Tee	7	15	0	8	0	0
♛	Hoop	7	0	0	7	10	0
W.I.W	Sheet	8	0	0	8	5	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote :—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 86in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12	10	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	15	0	,,

Galvanized Working Up-Sheets:

	£	s.	d	
24 G., f.o.b. London, in Bundles	13	10	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote :—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	
,, Best	7	5	0	
T's	7	0	0	
,, Best	7	10	0	
Best Shoe Iron	8	0	0	
,, Rivet Iron	8	0	0	
,, Best Rivet (Special)	9	5	0	
,, Cable	9	5	0	
,, Screwing	8	5	0	

	£	s.	d	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	4½
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	16	0	per ton.
Billets	at	3	18	0	,,
Sheet Bars	at	4	0	0	,,
Finished Steel:					
Bars	at	5	0	0	per ton.
Angles	at	5	1	0	,,
Tees	at	5	5	0	,,
Joists	at	4	12	6	,,
Fencing Standards	at	5	3	0	,,
Shoeing Bars	at	5	5	0	,,
Tyre Bars	at	5	5	0	,,
Half Round Bars	at	5	10	0	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d		£	s.	d.	
English Ingots, f.o.b. Dis 1¼%, & 1%	145	0	0	to	145	10	0	per ton
English Bars, f.o.b. Dis. 1¼%, & 1%	146	0	0	to	146	10	0	,,
Straits G.M.B., cash Warehouse, Net	144	15	0	to	145	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	143	15	0	to	143	17	6	,,
Australian, Mt. Bischoff, Warehouse, Net	145	0	0	to	145	10	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	12	6	to	68	15	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	10	0	to	68	12	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	74	10	0	to	75	0	0	,,
English, Best Select, Warehouse Net	74	10	0	to	75	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	83	0	0	to	84	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	78	0	0	to	78	10	0	,,
Electro, Warehouse, Net	75	15	0	to	76	0	0	,,
Ore, ex. ship	0	13	6	to	0	14	6	per unit
Regulus, Matte and Precipitate, ex ship,	0	14	6	to	0	15	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6	,,

SPELTER.

	£	s.	d.		£	s.	d	
Silesian outports, Net	26	0	0	to	26	5	0	per ton.
Blende of 50%, Net	6	15	0	to	7	7	6	,,
Calamine, Net	6	17	6	to	7	10	0	,,

LEAD

	£	s.	d.		£	s.	d	
English Pig, Warehouse, Dis 2½%	14	2	6	to	14	5	0	per ton.
Spanish, ex ship, Dis. 2½%	13	17	6	to	14	0	0	,,
Lead Ore of 70%, Net	7	7	6	to	7	12	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½%	60	0	0	to	61	0	0	per ton
Ore, 50%, ex ship, Dis. 2½%	16	10	0	to	18	0	0	,,
Crude, ex ship, Dis. 2½%	37	0	0	to	40	0	0	,,

QUICKSILVER.

	£	s.	d	
Spanish, 75 lb., Warehouse, Net	7	2	6	per flask.
Italian ,, ,, ,,	7	0	0	

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	1	0

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s	d
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.

	s	d
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.

London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅝ to 1 in. cube	5	0

STEAM—TOP HARD.

Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	10	,,
Tartaric at Manchester	0	0	10¾	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey ,,	11	15	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	10	0	,,
Arsenic: Best White Powdered net	14	10	0	,,
Bleaching Powder, 35% ,,	4	7	6	,,
Borax: British Refined Crystal ,,	13	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50/90 % ,,	0	0	7	per gal.
,, 90% ,,	0	0	6½	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	5¾	per lb.
,, ,, ,, 39/40° C. ,,	0	0	6⅛	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	7½	,,
Creosote, ordinary good liquid ,,	0	0	1¾	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	9	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	7	6	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	17	6	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	22	0	0	,,
Cyanides: 98% minimum f.o.b net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	15	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	15	0	,,
Nitrate	25	0	0	,,
Litharge, Flake	16	10	0	,,
,, Powder	17	0	0	,,
Red Lead, Genuine, c.i.f. London less 5	16	0	0	,,
White ,, ,, Dry ,, ,, ,,	17	0	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	6	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull	18	0	0	per ton.
Caustic, 75/80 % ,, ,,	20	5	0	,,
Chlorate net	0	0	$3\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	31	10	0	per ton.
Prussiate Yellow net	0	0	4½	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 % Ordinary ... net	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 % ... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % ...... net	6	10	0	,,
Caustic, White, 77 %...... ,,	10	12	6	,,
,, ,, 70 % ... ,,	9	12	6	,,
,, ,, 60 % ... ,,	8	12	6	,,
,, Cream, 60 %...... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate ...... c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs ...	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate ...... net	0	0	3$\frac{1}{16}$	per lb
Nitrate.. ex quay Liverpool, ... ,,	10	10	0	per ton.
Phosphate	9	5	0	,,
Prussiate ......net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)......	1	10	0	,,
,, (Saltcake, 95%)......	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers	7	10	0	,,
Zinc: Sulphate	6	15	0	,,
Shellac: Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports......	3	10	0	,,
Manganese: Lump c.i.f. Liverpool 10¼d. per metallic unit.				
Ochre: French JC ...... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk). c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55 %	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80 %	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %	91	0	0	to	93	0	0	per ton
Lead Ore, 70%					6	19	0	,,
Blende, 50%					6	9	6	,,
Calamine......					6	12	0	,,
Antimony Ore, 50%......	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	6	4	per ton.
Do.	,,	Cartagena	6	7	,,
Special low phos.	,,	Porman	6	10	,,
Do. do.	,,	Cartagena......	7	3	,,
Extra quality do.	,,	,, ...	7	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	......	10	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine......	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	5	0		7	10	0
Nova Scotia Spruce	,,	7	2	6		7	7	6
Spruce Boards......	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s	d		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak......	per load	12	0	0		16	0	0
Greenheart......	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s	d
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		14	0	0
Wyborg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this Journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C. at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When patents have been communicated the names of the communicators are printed in *italics.*

15379. W. Harbinger, London. July 26th. Improvements in fluid distribution valves.

15416. S. H. Adams, Scotswood-on-Tyne. July 27th.—Improvements in explosive engines.

15431. G. M. Wingard, London. July 27th.—Improvements in steam boilers.

15432. F. H. de Veulle, Coventry. July 27th.—Improvements in sparking plugs particularly for use with internal combustion engines.

15443. J. Roussat, London. July 27th.—Improvements relating to two stroke explosion engines. (Date applied for July 28th, 1904.)

15467. H. Binns, Leicester. July 28th.—Improvements in carburetters for internal combustion engines.

15476. J. Jackson, Liverpool. July 28th.—Improvements in, or connected with, lifts or elevators.

15477. W. C. Mitchell, Liverpool. July 28th.—Improvements in overhead travelling and furnace charging machinery.

15483. G. E. Gjuke, London. July 28th.—Improvements in hydraulic rock-drills.

15500. J. H. Corthesy and G. F. Griffin, London. July 28th.—Improvements in rotary engines.

15509. F. Berndt and A. Frankl, London. July 28th.—Improvements relating to lifting apparatus.

15523. C. A. Carlson, London. July 28th.—Improvements in internal combustion engines.

15525. G. Barker, London. July 28th.—Improvements in bridges or viaducts.

15558. G. Wilkins and H. Martin, Wealdstone. July 28th.—A hand trolley combined with [illegible] from the trolley and carried where required.

15571. O. Heer, Manchester. July 29th.—Improvements in rolling-mills.

15573. E. Bennis, Manchester. July 28th.—Improvements in fire bars applicable for steam boiler and other furnaces.

15579. J. Marston, Ltd., W. Newill, and J. Morgan, Coventry. July 29th.—Improvements in variable speed gears for cycles and the like.

15581. H. Davey, London. July 29th.—Centrifugal pumps.

15586. H. Luthi, London. July 29th.—Improvements in sparking plugs.

15595. A. Anderson, Liverpool. July 29th.—Improvements in derricks or hoisting booms.

17821. C.W.A. Taylor, Dunston-on-Tyne. Sept. 4th—Improvements in or relating to lubricators.

17869. A. H. Farmer, London. Sept. 4th.—Improvements in or relating to steam-valves.

17874. A. Rollason, London. Sept. 4th.—Improvements in or relating to internal combustion engines.

17896. The Electric Ignition Company, Ltd, and F. H. Hall, Birmingham. Sept. 5th.—Improvements relating to electrical ignition systems for internal combustion engines

17897. The Electric Ignition Company, Ltd., and F. H. Hall, Birmingham. Sept. 5th.—Improvements in electrical generator system for use with automobiles and the like.

17903. J. Meckenzie, Stockton-on-Tees. Sept. 5th.—Improvements in steam generators.

17926. J. J. Power, Glasgow. Improvements in rotary discharging apparatus.

17942. L. H. Hounsfield, and J. W. T. Cadett, London. Sept. 5th.—Improvements in carburetters for internal combustion engines.

17595. W. P. Thompson, Liverpool. Sept. 5th.—An improved automobile vehicle.

17986. J. Horsfall, Halifax. Sept. 6th.—A new or improved speed regulator for steam turbines and other engine water-wheels, and the like.

18047. A. Louis, London. Sept. 6th.—Improvements in vaporisers and carburetters.

18057. C. H. Bryant and G. Candelet, London. Sept. 6th.—Improvements in or relating to silencing or treatment of the exhaust from internal combustion engines.

18124. H. Lentz, London. Sept. 7th.—Improvements in blades for turbines.

18128. Belliss and Morcom, Ltd., and Alexander Jude, London. Sept. 7th.—Improvements in and relating to the construction and assembly of guide blades and [illegible] turbines.

18130. F. Jurgens, London. Sept. 7th.—Improvements in vacuum evaporating apparatus.

18417. G. W. Somerville and O. Hicks, Accrington. Sept. 8th.—Improvements in commutators for electric ignition of gases in internal combustion engines.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN, OR RELATING TO ELECTRO-MAGNETS AND SAFETY DEVICES USED WITH CRANES FOR LIFTING RAILS, INGOTS, OR THE LIKE.

S. Peech and Tozer, Ltd., and H. E. Bowen, Sheffield. August 7th, 1905. This invention relates to safety devices to be used in connection with electro-magnets employed with cranes and the like, for raising and carrying rails, bars, ingots and other metallic loads. The accompanying drawings

FIG 1

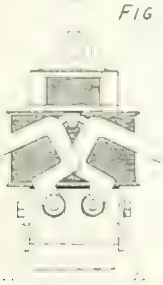
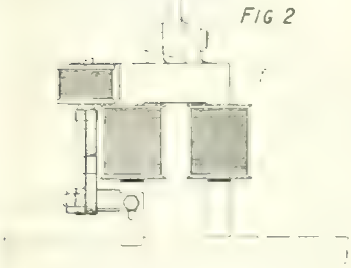


FIG 2

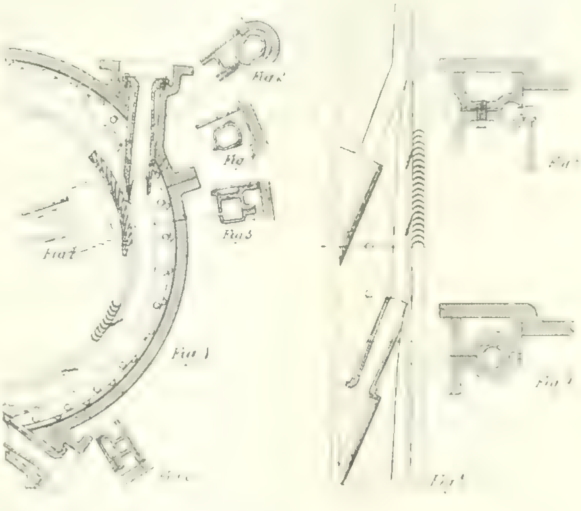


illustrate how the invention is carried into effect. Fig. 1 is a front elevation of an electro-magnet with a pair of safety hooks supported out of action by a small auxiliary magnet. Fig. 2 is a side elevation of same. From the crane is suspended a crosshead and upon this is secured one or more electro-magnets, connected by line wires with the source of electricity, and generally arranged so that they can be operated by switches located in the crane attendant's cage. These magnets are provided with self-adjusting guide plates or gauges, consisting of metal bars with elongated bolt holes, which are bolted to the outer ends of lifting faces of the magnets, but so that they can move vertically on the bolts or studs. They are for the purpose of passing down a small distance on each side of the object or objects to be lifted, such for example as ingots, bars or the like; but if when the magnets are lowered the guide plates on one side rest upon the face of the load, they slide upwards until as the magnets are moved laterally, they pass over the edge and drop back to their normal or lowest position which indicates that the magnets are in position for lifting the load. The electro-magnets are constructed to retain a sufficiency of magnetic power after the main current is broken, to sustain the load for a short period but sufficient to allow a number of pairs of safety claws, sustained out of action by means of a small electro-magnet, which loses its magnetic power immediately the circuit with the main magnets is broken from any cause, to turn upon their axes and drop instantly into the supporting position under the load, as indicated in both figures, before the main or lifting magnets lose their sustaining power. This automatic arrangement is practically useful during the quick loading of railway trucks and the like.

IMPROVEMENTS IN, AND RELATING TO TURBINES OPERATED BY EXPANSIBLE FLUIDS.

Belliss and Morcom, Ltd., and A. Jude, Birmingham. August 7th, 1905. This invention relates to turbines of the impulse type which are adapted to be operated by expansible fluids such as steam or gases. The principal feature of the invention consists in the adoption of such a form of supply passage for the steam or gas to the rotating wheel that, whilst a large area of flow to the wheel is provided, embracing the whole or a large fraction of the disc or peripheral area or the wheel, yet the number of such separate supply passages is very limited.

On reference to the drawings it will be seen that, for each branch which is adapted to be connected to a source of high pressure fluid, there is a mouthpiece or nozzle arranged to direct a stream of fluid into one end of a volute passage which subtends about one-third of the periphery of the rotor. Along the side of the passage, adjacent to the periphery of the rotor, there is a slit of uniform width through which the fluid escapes to impinge on the revolving vanes of an inward flow turbine or on to the surfaces of the buckets of a rotor of the Pelton wheel type, and exert an urging tangential force thereon.



A part of the fluid delivered from the nozzle passes at once through the portion of the slit adjacent to the nozzle, the remainder flows along the passage to find escape through the slit further on, the quantity required to be passed onwards diminishing gradually to zero.

In order that to all parts of the periphery of the rotor the fluid may be compelled to enter with the same velocity, the sectional area of the volute passage is at each transverse section of its length, made approximately proportional to the distance of that [illegible]

NEW PUBLICATIONS.

"ORE AND STONE MINING

A Treatise on Ore and Stone Mining. By [illegible] Le Neve Foster. Sixth edition, revised and enlarged, by Bennett H. Brough. Charles Griffin and Co., Ltd. [illegible]

The late Sir Clement Le Neve Foster's great work on ore and stone mining has [illegible] publication in 1894 been universally recognised as the best and most complete work on the subject in the English language. The author had hoped to rewrite it and bring it up to date, but unhappily ill-health prevented his carrying out this intention. At the request of Lady Le Neve Foster the task has been carried out by Mr. Brough, his former assistant at the Royal School of Mines. Matter that has become obsolete has been deleted and recent progress has been duly noticed, so that the book has now some fifty pages more than the original edition, and having been reset and revised throughout, is considerably improved in appearance. The logical arrangement arrived at by Sir Clement after his fourteen years of teaching at the Royal School of Mines and his twenty-nine years of Government mine inspection is, however, practically unchanged, the chief addition being a carefully selected list of references, in which fuller information can be sought, at the end of each chapter, and a useful index of authors cited. Comparing the present edition with previous editions, we notice, amongst the new matter introduced, recent information regarding the occurrence of iron ore and of phosphates, notices of Marriott's researches on the deviation of diamond drills, descriptions of the Fauck and Raky methods of boring, of the Water-Leyner drill, the helicoidal wire saw, the Aetna Company's low tension fuse, hydraulic sluicing, the milling method of mining at Lake Superior, high lift centrifugal pumps, recent observations on underground temperatures, Hadfield and Jack's stone breaker, Morison's high-speed stamps, magnetic separation at Dunderland tube mills, the Buss vanning table, the new Baltic stamp mill completed this year and the treatment of rare earths, as well as accounts of American mining law, miner's phthisis in the Transvaal, and the new special rules that came into force in Cornwall this year. These few examples taken at random will show that the information has been thoroughly brought up to date, and that the encyclopædic character of the original work has been well maintained.

"THE PRINCIPLES, CONSTRUCTION, AND APPLICATION OF PUMPING MACHINERY."

By Henry Davey, M.Inst.C.E. Charles Griffin and Co. 21s. net.

It is not surprising that a second edition of this book has been rendered necessary, for it is really a standard work on the subject of which it treats, and the information is presented in such a form as to make it most useful to the practical engineer engaged in the application of pumping machinery in mines and elsewhere. The text is copiously illustrated with some [illegible] and a number of plates. The [illegible] chapters are devoted to the history of pumping engines and the descriptive matter dates back to the historic Savery engine, the use of which was illustrated before the Royal Society in 1699. An interesting section of the book is that devoted to mining engines, the conditions of mining being so varied that many [illegible] deals with pit work, hydraulic transmission of power in mines, largely employed for pumping purposes, and with the electric transmission of power to pumps. It is pointed out that the mechanical efficiency of the direct acting mine pumping engine may be taken at 80 per cent., while waterworks, pumping engines and pumps combined have a mechanical efficiency of 85 per cent., an efficiency little influenced by variations in speed. Electric systems have not, of course, that degree of constancy, the centrifugal pump only giving its maximum efficiency under critical conditions, so that not more than 50 per cent. can be calculated on in practical work. Some space is given to the consideration of water pressure pumping engines, and an important chapter is devoted to a consideration of the question of pumping economy, which is replete with statistical information of official trials of pumping engines both in England and on the Continent. The congratulations tendered to the author on the issue of the first edition may be reiterated.

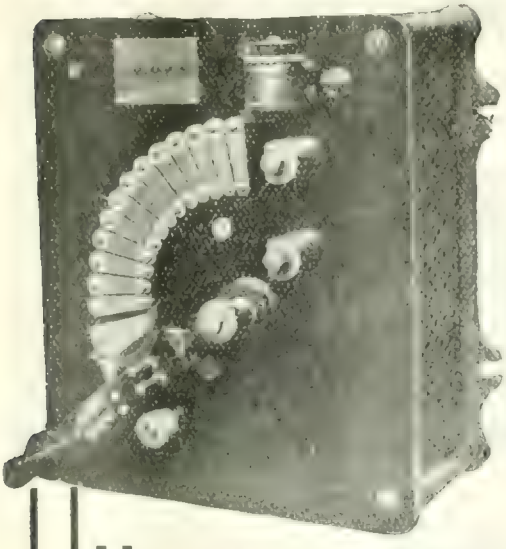
NEW CATALOGUES.

The Electrical Company, Ltd., 121–125, Charing Cross Road, W.C. We have pleasure in acknowledging receipt of the following: Pamphlet No. 155, Nernst lamps for street and shop lighting. Leaflet No. 163, Patent suspension chain. Card No. 166, Flame arc lamp instructions. Leaflet No. 175, Watthour meter; No. 176, Switchboard meter; No. 177, New Nernst lamp reflector; No. 178, Artistic Nernst lamp fittings. Card No. XIII., 142–62, Small motor. Card No. XIII. 146 A5, Electric fans. The G.G. type D.C. watthour meter for switchboard work is described as measuring accurately over large and sudden variations, both in current and pressure, and as entirely unaffected by stray magnetic fields. It is made in following sizes—300, 500, 600, 800, 1,000, 1,500, 2,000 amperes; voltages 100 up to 2,000 volts, in two and three wire types. An overload capacity of 100 per cent. for one hour is a special point in the construction of this meter.

For convenience of filing these pamphlets and circulars we think the company would reap considerable advantage by adopting a standard size. Only in this way can a neat and tidy file of loose papers be kept, but it is a feature which the makers of catalogues and circulars too frequently ignore.

Johnson and Phillips have issued in the form of a card, intended to be filed in a card index, a reminder that they are the manufacturers of electrical plant, large or small, for power, lighting or traction. The following catalogues are also listed and can be had on application: A, continuous-current dynamos; B, continuous-current motors; C, alternators; D, transformers; E, polyphase motors; F, electric light fittings; H, arc lamps; LA, electric light accessories; SB, switches and switch gear for generating stations; SG, electric light shades and glassware. The card reference idea is commendable, but it would be improved by bringing the information afforded into line with the ordinary data of a card index. Thus "Johnson and Phillips" or, better still, "Electrical Plant" might with advantage appear in a single line at the top of the card on the left-hand side. A larger punch-hole would also improve the card for practical purposes.

PAGE'S WEEKLY Miscellaneous



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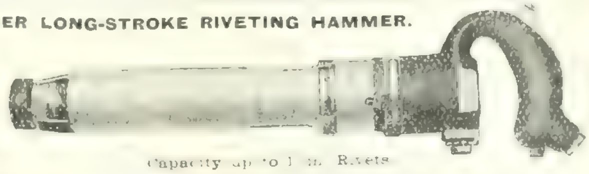

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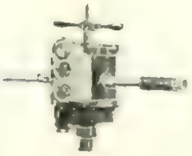

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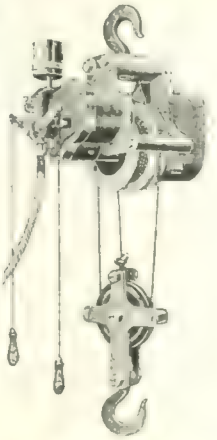

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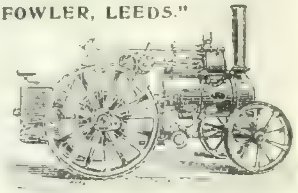

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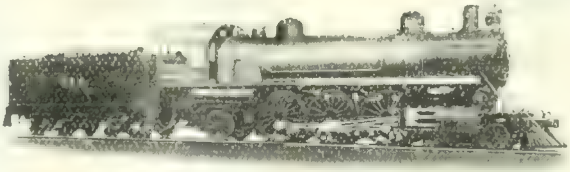

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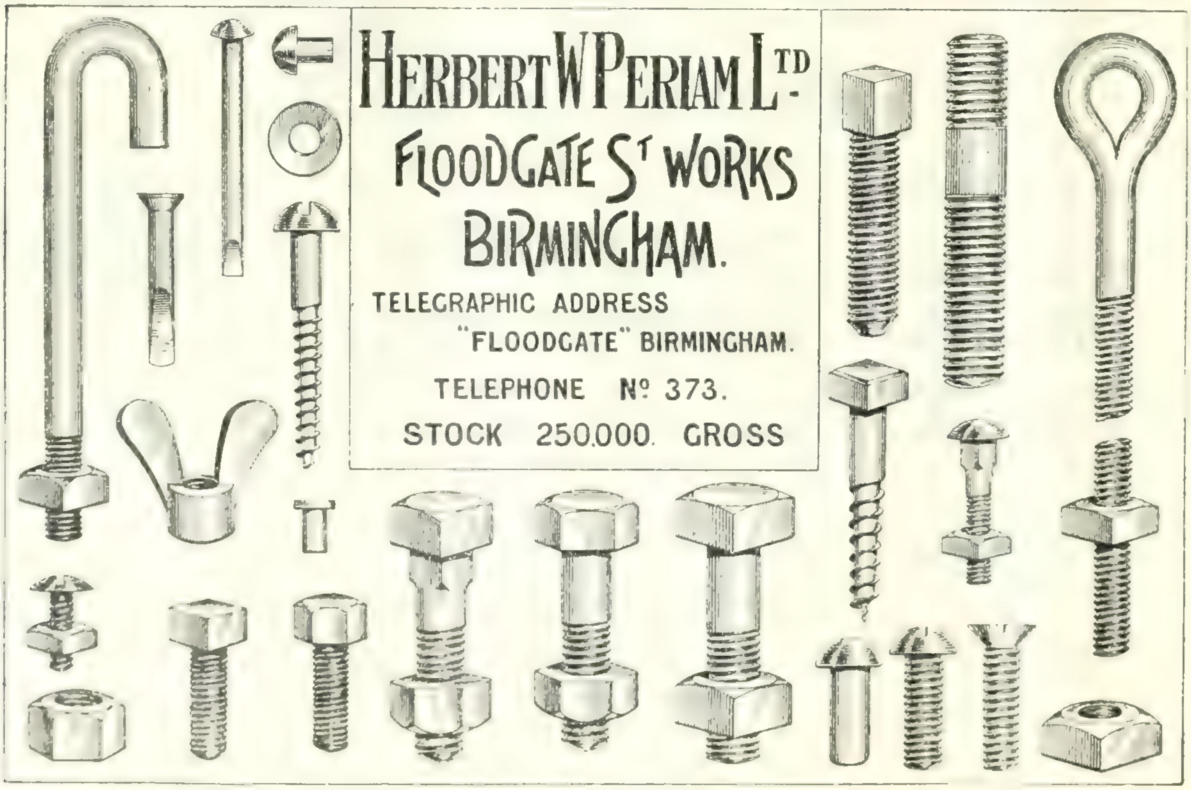

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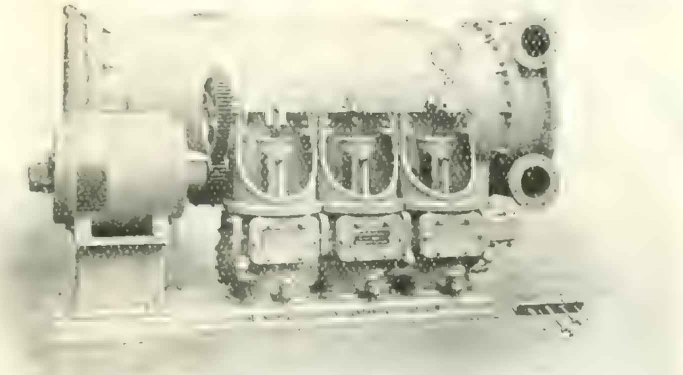

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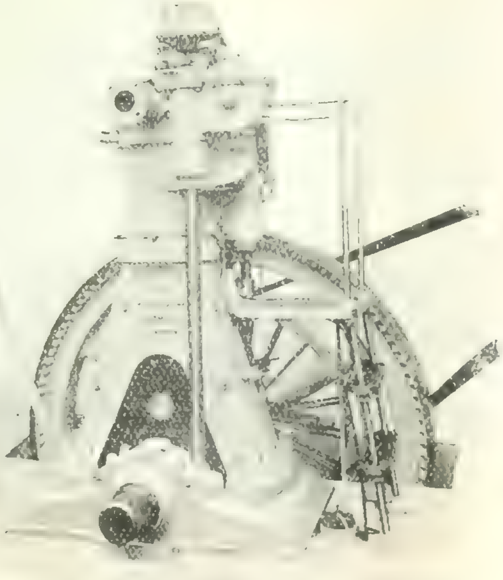

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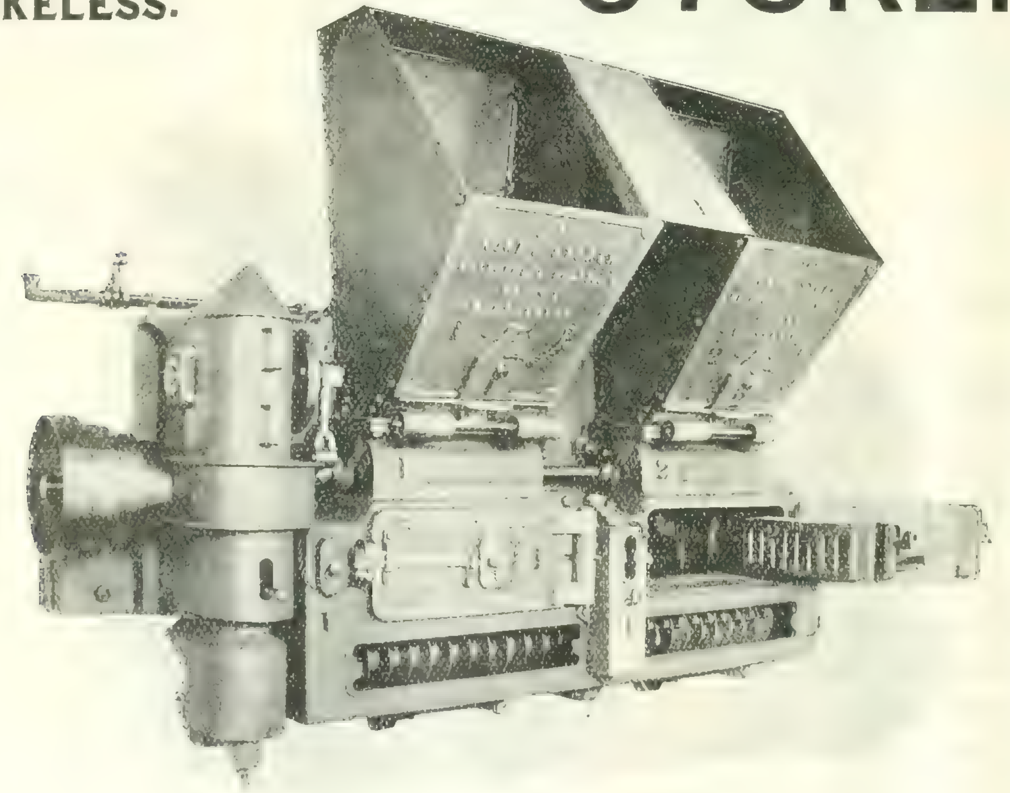

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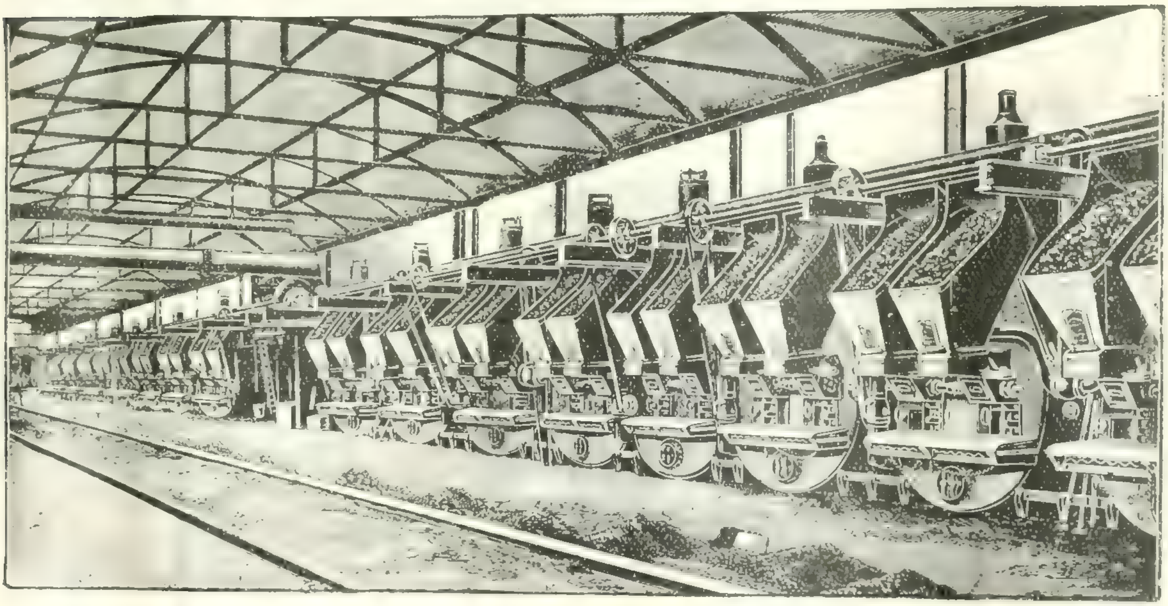

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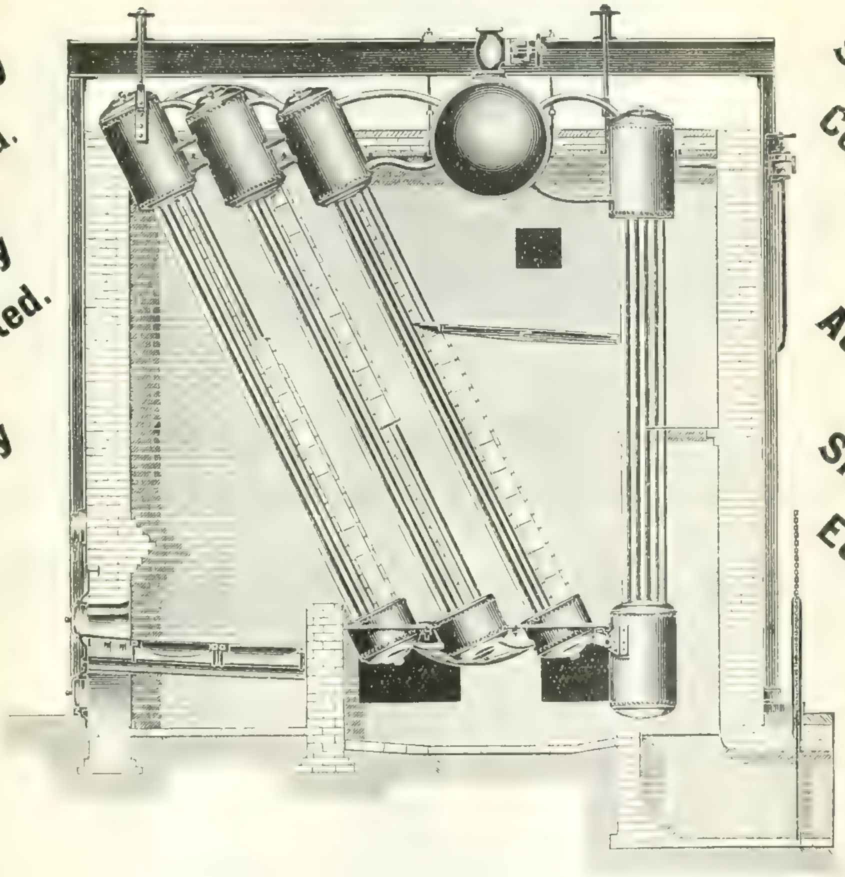

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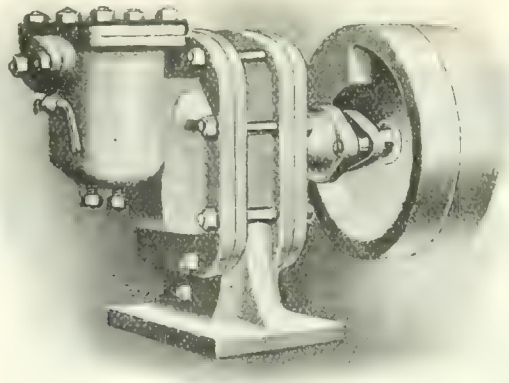

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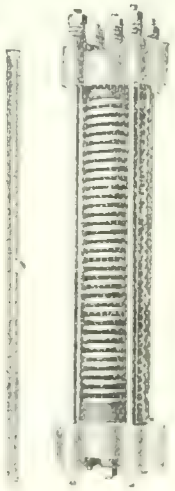

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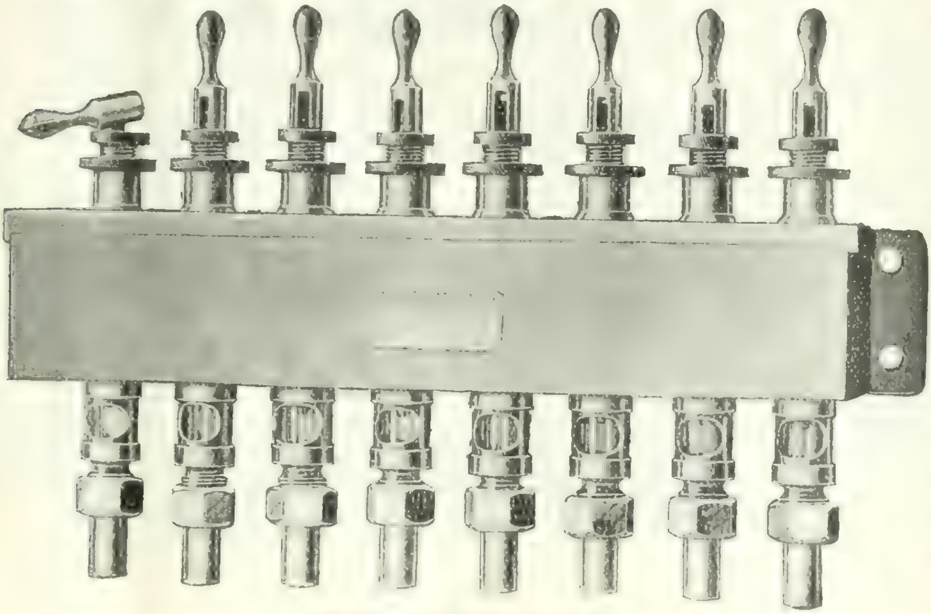

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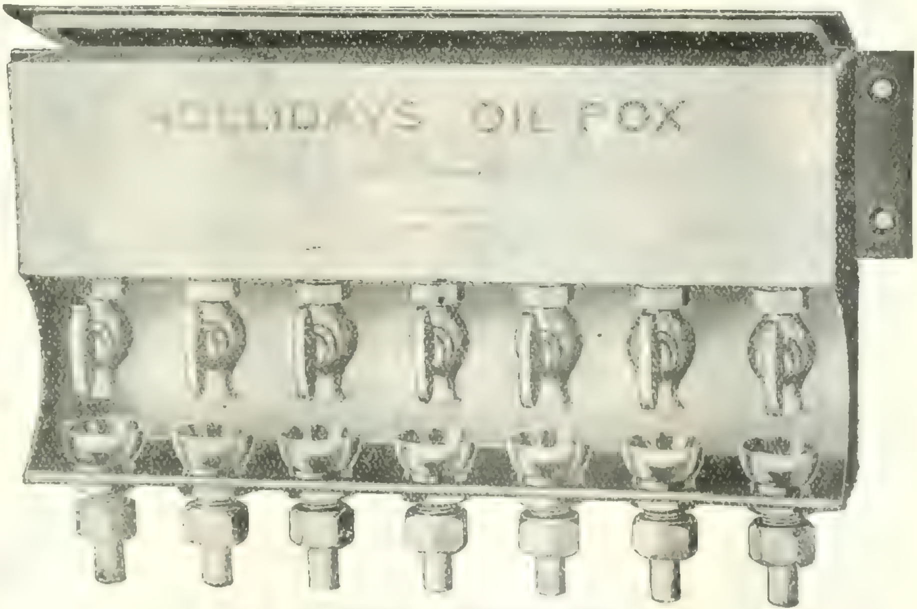

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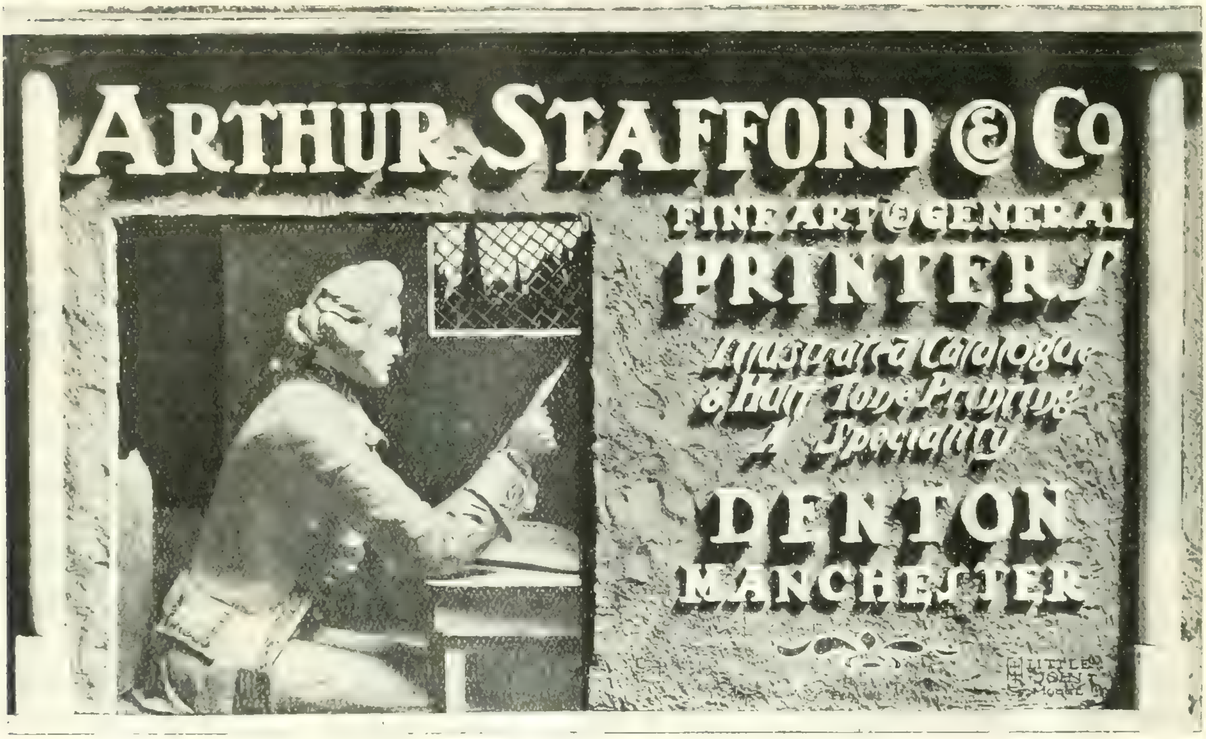

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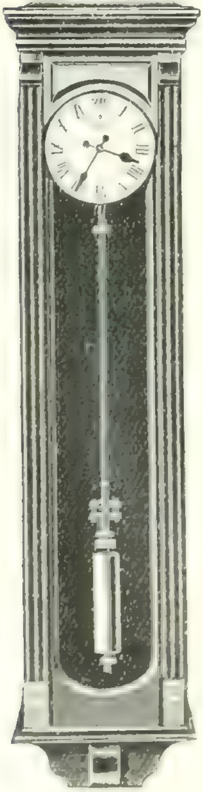

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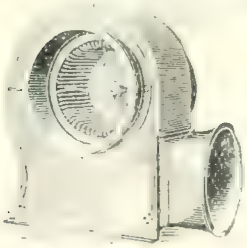

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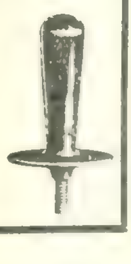

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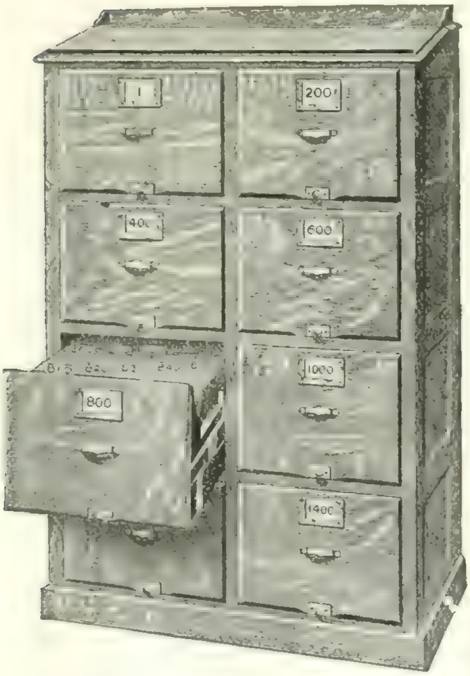

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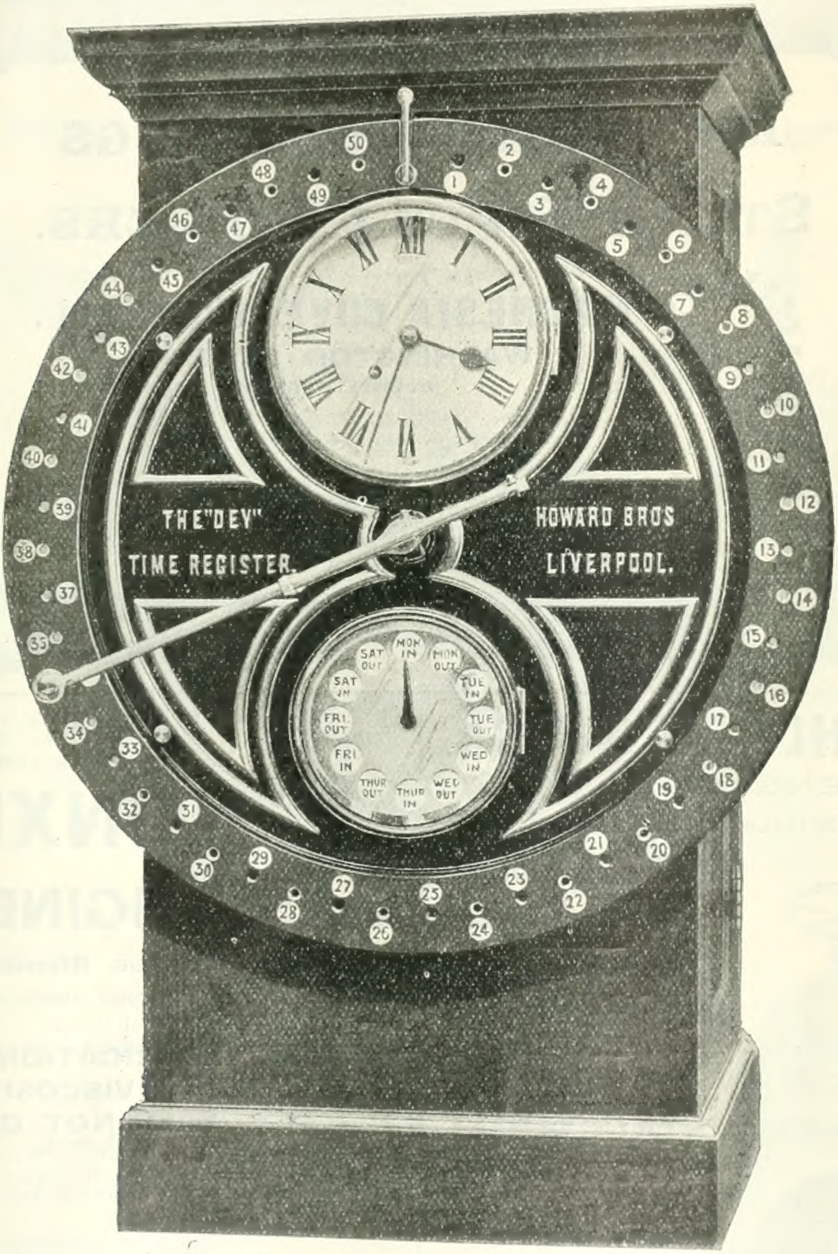

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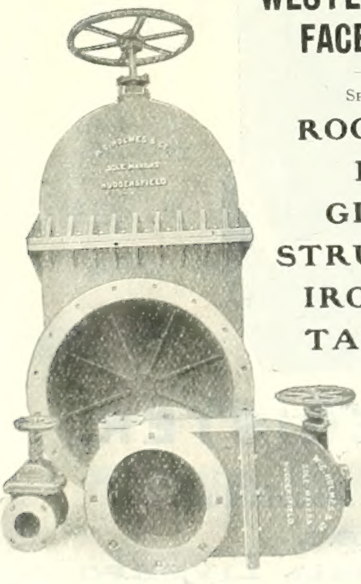

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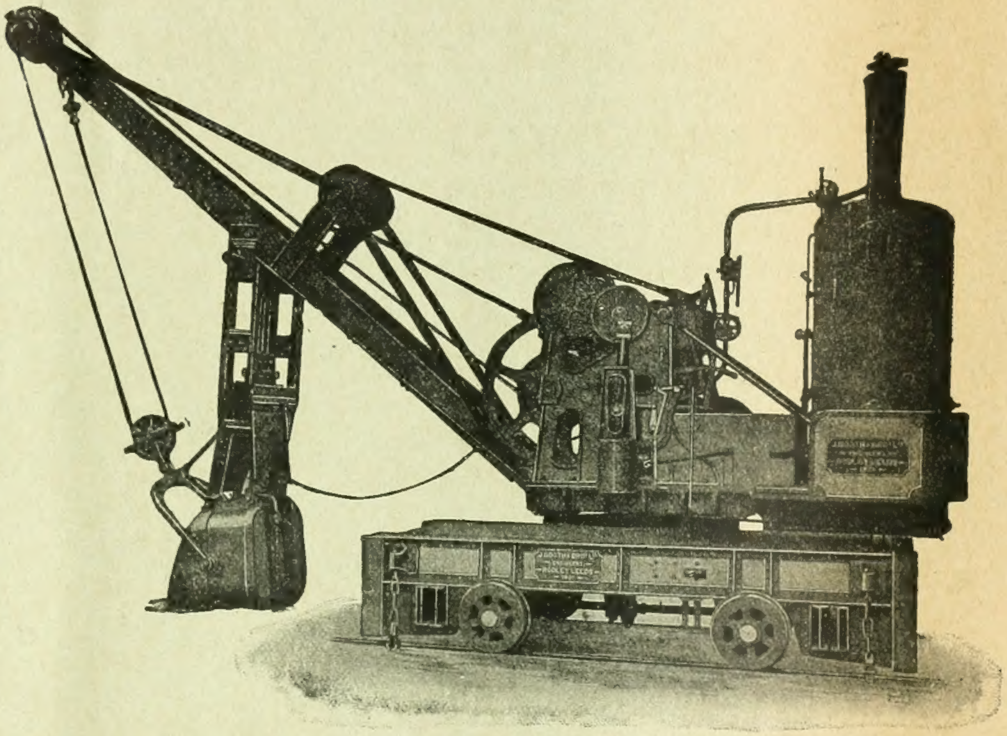

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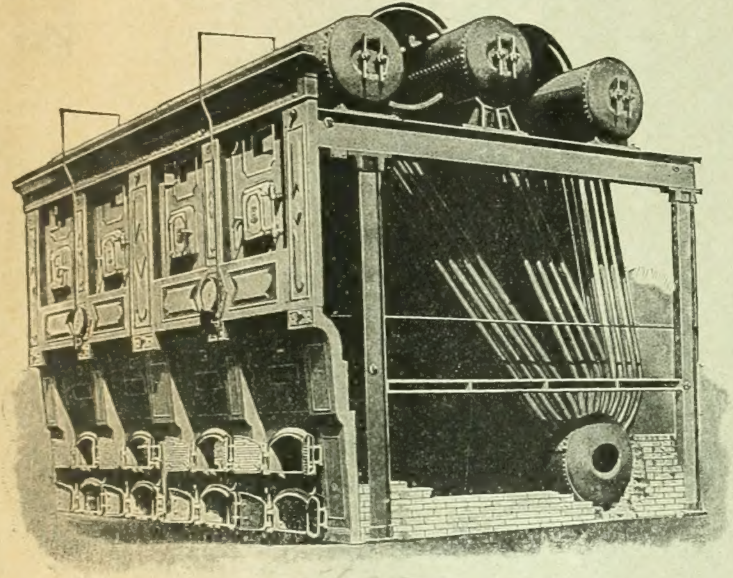

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